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THE TECHNIC.

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THE TECHNIC extends to all of its readers, senior and freshman, professor and student, its best wishes for an enjoyable holiday season and a fortunate and happy New Year.

A SEASON'S observation of the working of the new football rules results in the impression that they were well devised for the end in view. "To preserve the game and eliminate the objectionable features" was said to be the object sought, and it seems to have been attained. From a spectator's standpoint the game is better than formerly, and it is just as popular with the players.

IN accordance with precedent which has become custom, the matter in this issue of THE TECHNIC is not confined as strictly as usual to scientific subjects. As leading article, we are glad to be able to present to our readers, a paper by Prof. Wickersham on "When Coal Gave Out," to which is added some of his earlier writing in verse. Mr. Trowbridge's paper on "Uses of the Telephone" speaks for itself. Mr. Bareuther's experience of several years as train dispatcher for the Big Four eminently fits him to write interestingly on the subject which he has chosen.

IF the large new bulletin board in the main hall were sensitive to insult, it would probably before now have fallen to the floor and gone in search of a champion to protect it. Should Ali Baba stroll into our corridor as he strolled into the warehouse of the forty thieves, and read the "LOST" notices pinned on this board, he might perhaps feel quite at home. Of these notices there were recently no less than six at one time, and some plainly intimating that the heading "LOST" was written in irony. The board is there to receive just such placards, but it is unfortunate that so many of this nature should find a place on it.

THE Camera Club has departed from its one-time exclusive devotion to the black art of the dark-room, and is successfully showing that it is an active, stirring organization. It ought to have on its membership roll all the gentlemen of squeeze-the-bulb or press-the-button tendencies that there are in the school It is evident that photography is an aid of increasing importance in a number of lines of engineering work, and a reasonable amount of skill in the use of the camera is neither hard to acquire nor expensive. In addition to the opportunity

for getting experience, there are lectures to be heard, competitions to be entered, prizes to be won and the fellowship with kindred spirits to be enjoyed.

We regret that the results of the club's first photographic contest were not announced early enough to permit the reproduction of the prize-winning pictures in this issue of THE TECHNIC.

THE art of finding out what some other man knows, not being sure that he knows it, since he does not think to tell it voluntarily, is a large part of the work of practical journalism and is not always easy. One flight of imagination of the story-teller of the Arabian Nights has not been paralleled by modern invention; the gentleman who woke to find himself in a chair surrounded by twelve thousand serpents, each a hundred yards long, headed by a queen who was crammed full and bubbling over with varied information, has no successor in modern times. The average newspaper editor would probably be willing to take his chances with the serpents if he could but find the chair, even though they were created especially for active service in Gehenna; by their aid he would be able to keep his rivals "scooped" all the time.

The value of this observation lies in the application of it. The class of '09 has made a bright and early start toward the work on next year's Modulus, by electing chief and assistant editors and business managers. The path of these men is not thickly strewn with roses, and those that are there have thorns. As far as we know, there is no magic chair of general information about the Polytechnic premises; if there were, we should ourselves use every strenuous effort to get a first mortgage on it and then foreclose. The quality of the next Modulus will be enhanced by the active help of the students of all classes. If a novel idea or a good drawing or a promising story springs up, let the Modulus have the benefit of it rather than let it slip away. The '09s get all the glory to be sure, but they have the work and the worry too, and the men of other classes should do what they can to help the publication to a successful completion.

DURING the past year it became evident that the fundamental laws of some, if not all, of the student organizations, were not wholly satisfactory under the present conditions for the government of the bodies to which they applied, and that sooner or later a revision of constitutions would have to be undertaken, so that the unity of the family of student organizations might be put beyond question, and their mutual relations clearly defined. The constitutions of some of the organizations are either silent or vague respecting matters on which they should be explicit, under existing conditions, having presumably been left thus to allow of amendments of a nature to be indicated by future events, or to give flexibility and a reasonable range of interpretation; but the range is so great that it was thought better to reduce it rather than run the risk of decided differences of opinion.

The Student Council has taken the lead in this matter, a committee having been appointed several weeks ago to make recommendations as to changes in its present constitution, or possibly its abrogation and the adoption of a new one. The Camera Club has taken action along the same line. The process is necessarily a slow one, and if the work is wholly finished by next May, it will probably be as much as could be asked.

WHEN COAL GAVE OUT.

A FANCY.

By J. A. WICKERSHAM.

THE future historian may, perhaps, write as follows of the cessation of coal-mining on the earth :

"We had been living in an age of great progress, of wonderful development.

"As long as coal existed to enable man to work the mineral deposits of the earth, development had gone on rapidly and continuously until, at last the position was reached which the world attained in the middle of the twenty-third century. This may be called the greatest century of the coal-using age, the grand climax of man's life on earth, the apex of his highest achievement.

"This was the time when great lines of railroads had traversed all the continents, flown over all the mountain chains, and tunneled all the straits of the world; when great lines of steamers crossed all the oceans, and aerial navigation had had successfully ransacked the extreme limits of the frozen regions of the poles.

"At that time all the peoples of the earth, by intercommunication, amalgamation and the survival of the fittest, had assumed the same general attributes of form, color and custom, so that there were no longer either Mongolians or Africans, Caucasians or Malays in all the earth, but only one homogenous, cosmopolitan people.

"Free trade and nationalism, individualism and paternalism, by different routes had reached the same end of absolutely highest development, and the individual advantages of each separate nation had been impartially distributed among all the others; though one nation might set the style of dress or lead in some other respect and another might write the literature, still another make the laws and all the rest in their turn do that alone for which nature had most peculiarly adapted them, yet all, by this close communication and intercourse had been able to take immediate advantage of the development of their neighbors and become at once their co-workers and their equals.

"Religion had become absolutely uniform throughout the earth, that is, as far as there still existed upon the earth any religion, for it must be recognized that, with the advancement of culture, the old religions had almost entirely merged into one another and disappeared, and only a mild, ethical philosophy, comparable to Confucianism or Christian ethics had come to reign in their stead.

"What superstition still remained in the world had taken refuge in some secret corner of material science, where it sought to explain and expound the mysteries of psychology or the abstractions of metaphysics by the existence of some subtle essence or etherial element or life-giving force in the atmosphere.

"Such was pretty much the philosophy of the times, a philosophy comparable in every respect to the material condition of things, a philosophy uncontaminated or rendered narrow, to use the jargon of that age, by anything provincial, characteristic, or peculiar.

"All men were thought to have come up gradually by a process of evolution from lower forms of life, these in turn from still lower forms, and the last in the progression to have originated by spontaneous generation from the same incomprehensible, but still existent life principle, which had escaped from superstition to hide somewhere in the domain of science.

"Everything was understood and made reasonable and clear to the intellect, while faith and superstition had been relegated to the dark ages.

"Politically, a form of world socialism, introduced by the Hague conference, had usurped the place of the individualism and national life of the times preceeding the twentieth century, and gradually brought about a reign of peace, co-operation, and equality, so that all people were now alike in social status and there existed no longer either rich or poor, powerful or weak, but one mighty swarm of people as similiar to one another as one ant of an ant hill is to all the rest.

"Industrially, great steel structures, each separately containing whole tribes of people,

towered up into the heavens from all the cities; lightning, generated by the fall of the cataracts, the rise and fall of the tides, and the blowing of the winds, had been harnessed and tamed to aid the coal in doing the work of the world; great chemical discoveries, by which the earth's atmosphere had been caused to yield up her free nitrogen, had so fertilized the soils that life could be supported in countless numbers so that even the theories of Malthus had been shamed, and made to retire to await a more favorable age for their application; in those days a spirit approaching from the planet Mars or other supramundane sphere, long before reaching earth, would have heard the busy hum of millions of iron wheels, and turning shafts, and descending steam hammers, to say nothing of the countless voices, speaking or singing the same uniform Volapuk or Esperanto.

"A uniform language had of course at that time become a necessity.

"This, then, was the condition of things at the time of the great climax, this the happy state of the age of coal using, when suddenly coal gave out.

"We say suddenly, but of course that statement must be taken with a grain of allowance.

"Seers had long foreseen this catastrophe, and been preparing for it. They had measured the extent of the coal mines, the oil deposits, and the stored gases of the earth's crust, and calculated to a nicety how long they could still continue to support the population of the earth, and in their efforts to put aside the operation of the inevitable law of diminishing returns, had learned how to burn the waters of the sea, to focus with powerful lenses the rays of the sun, and capture the internal heat of the earth through volcanoes and artificial borings, and had, thus, shoved off as far as possible the inevitable time when coal should give out.

"Laws had been in operation many generations preventing waste, demand had been kept within as reasonable limits as possible, the birth-rate had been studied and controlled in order to make the extent of population keep even pace with the threatening decrease of coal; but, as could well be foreseen, all these preventative measures had at last been of no further avail and coal had given out, the great coal fields had all been exhausted and had fallen in, and these were soon followed by the complete exhaustion of the lesser ones.

"With the cessation of coal mining, iron also ceased to be mined and worked, the earth had long since been denuded of its forests, the great steel structures could no longer be maintained, and fell to pieces, or remained standing, cold, cheerless and uninhabited.

"Soon after the cessation of the mining of iron came that of copper, and with this began the disintegration of the great lines of communication, cables, telegraphs, and telephones; and, though the wireless continued to give its efficiency longest, it too, became less and less serviceable, partly because of the difficulty of replacing the delicate instruments, and partly because the cessation of international traffic rendered its use unprofitable and impossible.

"Now came the last run of a transcontinental train, the last passage of an ocean liner, the last air trip of any considerable extent, soon followed, or in many instances preceded, by the breaking up of all the large businesses, the largest trusts and monopolies coming first, only the smallest and simplest being able to stand the strain.

"Each district being in part only self-supporting, people now begin to die everywhere as by a black pest or an Asiatic cholera; being no longer able to help themselves, wherever they were caught, there they were obliged to remain and suffer the consequences till, at last, in the general process of decay all the great land marks of progress, all the great centres of population, all the great monuments of civilization, were swept from the earth and disappeared entirely.

"Contemporaneously with this process, however, a world of little communities had again been formed. These had rapidly become isolated, had assumed peculiarities, odd characteristics, strange customs. In the northern climes white tribes had developed, in the southern,

black ones; between them various shades and degrees of color, while the stored intelligence of the world, by the natural growth and development of new dialects and languages, had destroyed the knowledge of the world language in which every thing had hitherto been written, destroyed, that is, except for the very few learned men who now formed schools to interpret it and teach to the descendents of former ages a few meager dribblings of the learning of that famous period.

"Now, singularly enough, religions begans to arise again; the beliefs of man to assume form and color; tradition took on aga n the beauty of myth, angels came back to earth with spirits, gods and demigods; heroes were born, and herculean labors were told, all of which personified in some manner the wonderful works of the great and mighty times of the age of coal.

"This was now becoming again a pleasing period. It is true the art of working in metals was lost, but agriculture as formerly practised was revived; there arose now a new primitive life, archaic, idyllic, Acadian; man was again approaching the condition of his ancestors, his forbears were becoming his descendants; everything in nature goes through a course, a progression; the lark that soars into the lofty heavens, must again descend to earth, nothing can remain forever in motion, the impetus must again be given by some new discovery or

The simple life of earth's primeval man,
Will end his reign as when it first began."

EARLY POEMS.

By James A. Wickersham.

OAK AND VINE.

I'd be an oak with shaggy bark,
With spreading boughs and shadows dark,
And every windy wave of mine,
Should rock the cradle of thy vine.

THE FLASHES.

Yesterday night
I paddled alone
Where the phosphor light
On the waters shone,

And dipped my blade
In the moving brine,
Where the flashes played,
To see them shine.

A silvery smile
On the waters glowed,
To show for awhile
Where I had rowed,

But every spark,
From beneath my oar,
Again grew dark
As it was before,

And I reached the shore,
To walk alone,
And think no more
Of those lights that shone.

SHEPHERD AND SHEPERDESS.

A shepherdess, one day in June,
Watched her idly grazing sheep,
While the heat of sleepy noon
Stole upon her sense, and soon
Lulled the shepherdess to sleep.

Thus the shepherd found his dear,
Sleeping in the summer shade;
Half in glee and half in fear
Slow approached and, standing near,
Gloated o'er the sleeping maid.

Then he stood and drank the sight,
Unto him like luscious wine,
Unto him like autumn night,
Shading, all in softened light,
Ripened clusters on the vine.

Suddenly his gloating fell,
Base desire banished thence;
Who that mystery can tell
Changing bad to good at will,
At the sight of innocence?

Grapes no more, but lofty trees
Seemed to him her features each;
Fruit, 'tis true, his taste to please,
Hanging loosely in the breeze,
But, alas, above his reach.

Then he stooped, and plucked a flower,
Laid it to his hairy lips,
Laid it — bending 'neath the bower,
Shading her in noontide hour—
Softly twixt her finger tips.

Thus did shepherd leave his dear,
Sleeping in the summer shade;
Half in glee and half in fear
Crossed the plain to disappear
From the pretty, sleeping maid.

THE WILDFOWL.

A wildfowl sat on the water
On a bleak and barren moor,
And dreamed of her distant comrades,
On a sunny, southern shore.

And nearer the dangerous crystals
Of ice were gathering 'round;
They reached at length to her bosom,
And broke with a warning sound.

She started, her dream was broken,
And looked out into the night,
Then thought of the darkness and shuddered,
And sank back to wait for the light.

The light came up in the morning,
And ran his course o'er the wave,
And softly carressed the wildfowl,
Asleep in her icy grave.

LIFE'S CYCLE.

Oh life begins with a quiet morn,
But long e'er the noontide strife is born.
And the heart is worn in its struggle with pain.
And longs for the quiet morn again.

But noontide past, the eve comes on,
And struggle and strife from the spirit gone,
The soul looks out and far away,
And longs for the dawn of another day.

VAE VICTIS.

As the green grass groweth forth in the springtime,
And raiseth its head though to earth it is bound,
To sway neath the storm winds and blasts of the summe
Till bent by the frost it returns to the ground:

So, so is man, a slave to earth's misery,
Struggling, rebelling, remaining a slave;
Where he went forth in the hope of the morning.
There, there returning at night to his grave.

Woe, woe to man, since earth is his mother,
And pain is the nurse that encouraged his growth;
Soon, soon he striveth to leave them, and bitterly
Learns himself bound and enslaved to them both.

LONELINESS.

Oh, where can I find a voice to tell
How lonely I am, how my heart will swell;
How wherever I stand,
I reach out my hand,
Some other to press
Some cheek to caress,
But everything flies as the wind away,
When I approach it and bid it stay.

Oh, I envy the waves as they roll on,
For they are together but I am alone;
I saw in the sky
Two clouds sailing by,
But a minute passed on,
And they grew into one;
And I stood still on the shore alone,
And looked in the emptiness whence they had flown.

A child come playing along the strand,
Tossing the shells and sifting the sand,
Its cheek like a shell,
Its voice like a bell,
Come, come, pretty boy,
That, that is a joy,
O it warms my heart as a summer day,
But it, as the rest, went away, away.

So whatever I find, it soon is gone,
And I am then left alone, alone;
And now even you,
Little verses that flew,
You. too, brought me joy,
But, alas, you have flown,
And left me alone.

THE MOON O'ER THE CASTLE.

Valley and hill and river
Are bathed in thy tender light;
And around the old castle quiver
The shadows of the night.

Thou hast lighted, nights without number,
The rooks to their moss-grown rest,
But to-night thou awakest from slumber,
The thoughts in a traveler's breast.

Thou wakest with magic power
The fancies that rise and fill
The nooks of this fallen tower,
Asleep on its rocky hill.

When the traveler's rest is over,
He will rise and go his way,
But never forget the moonlight
That round the old castle lay.

SOME USES OF THE TELEPHONE.

By CHAS. B. TROWBRIDGE, '05.

THE great increase in the number of telephones during the past ten years has been widely commented on in both the public and technical press. It does not require a large imagination to conceive the magnitude of the system if the present rate of increase keeps up. And it is the telephone engineers of to-day, who have brought this most useful invention to its present state of perfection. At the present time the number of good telephone engineers in the country is comparatively small, but this number is being rapidly increased. The technical schools are including a telephone course along with the electrical, mechanical and civil courses and the large manufacturers of telephone apparatus are following the lead of the Westinghouse Co., the General Electric Co., and the Allis-Chalmers Co. and installing apprentices' courses for graduates of technical colleges.

This means that in the near future, we will have more efficient help in the Telephone Engineering Departments, and who knows but that we may soon be able to see as well as hear over the phone. Imagine the usefulness of such an invention. The retail merchant could call up the wholesaler, ask him to hold up samples in front of the phone, while he selected and bought without moving from his desk. The housewife could do the same with the grocer, the doctor with his patient, the buyer with the farmer. And a telephone of this character is now being experimented with and has been perfected to a certain degree.

The present telephone is as valuable to the farmer as to the business man and the uses of the rural line are constantly being extended and systematized. The government weather service is being greatly increased in value through the co-operation of the telephone companies. On a great number of lines throughout the country at the present time, at a designated hour in the morning, a general signal is given on the lines. This is known as the weather call and every farmer goes to his telephone and receives the prediction for the coming day. The plan has passed the experimental stage and as the Weather Bureau is trying to secure the co-operation of the greatest possible number of telephone companies, it is likely that the benefits of this regular service will soon be available to all rural line subscribers. Plans for a regular news service over the telephone lines in many sections of the country are already well under way. In this way the isolated telephone subscriber is able to keep in touch not only with those near at hand but with all the outside circumstances which are capable of affecting his affairs in any way.

As to the novel feats made possible by the use of the telephone, we can find one right here at home. Within the past year, a man committed a misdemeanor in Terre Haute and fled to Illinois, where he was arrested. Rather than return to Indiana for trial, he conducted his own defense over the telephone, was found guilty and paid his fine, all by telephone.

The novel feat of tuning a piano by telephone

was recently accomplished by Mr. M. J. Archer, a piano tuner of Wabash, Ind. Mr. Archer sold a piano to a gentleman in South Bend and later this gentleman called Mr. Archer up and advised him that the piano needed tuning. He was asked to sound the instrument, which was near the telephone. The tone was transmitted clearly to Wabash, and directions were given to change the tension. These directions were carried out and the instrument repeatedly sounded until it was perfectly tuned and the tones all normal.

I myself recently saw a novel use of the telephone. While seated in a barber shop in Chicago waiting my turn, I heard a telephone bell ring and presently a boy came up carrying a portable desk phone, inserted the plug in a jack in the wall and handed the phone to a gentleman who was being shaved. The gentleman evidently was a piano dealer and before he had replaced the receiver on the hook, he had closed the sale of a piano, which he apparently had been trying to dispose of for sometime.

In New York city a novel automobile trap has been devised, with the telephone as the principal factor. Quoting from a prominent magistrate of New York, he states, "That the ordinary man is a law abiding citizen until he owns an automobile, but that when riding in it, he seems to be transformed into a demon." It is an absolute certainty that a person riding in an automobile seems to lose all sense of perception of the speed at which he is traveling. And so in New York, instead of leaving it to the guess work of a policeman as to whether the law was being violated, the following idea was carried out: A stretch of road frequently traveled by automobiles was selected and divided into two sections. At each end and at the connecting point of these two sections, observation booths were placed. These booths are in charge of police and are connected by telephones, which are employed to establish instantaneous communication between them. The system is worked in this manner. When an automobile passes either of the end stations the officer gives the telephone one ring and the officer at the middle station starts his stop watch. The end station man then telephones the number of the car and the direction in which it is going. When the car passes the middle station, the watch is stopped and the speed of the car is quickly read off a chart and and if it is traveling faster than the prescribed fifteen miles an hour, the operator at the further end station is notified, the car is stopped and the party warned. On the second offense the party is arrested, held for trial and fined. The average speed so far recorded has been fourteen miles an hour, and the highest thirty.

To confer a title of nobility by telephone is a typically modern way of promoting. Herr von Bülow, having not long ago, settled an international dispute with Spain over some South Sea Islands, received by telephone the following message from a high officer in the Imperial household: "I am ordered to inform your Excellency that His Majesty confers upon you the title and dignity of a Count of the German Empire."

The successful use of the telephone in warfare has been established beyond a doubt. The battle of Mukden in the comparatively recent Japanese-Russian war, marked an epoch in the history of applied telephony. In looking into the causes of the Japanese victory in that battle, science is found to be the main factor, both the science of method in general and the science of modern methods of communication in particular. The utilization of the telephone meant dispatch and precision. It meant intelligent and instantaneous control of the marching forces. It meant that the great military commanders could play their game of chess with destiny, without fear of rout or confusion.

Wireless telegraphy has been proved a commercial success and it is evident that wireless telephony will not be far behind. It only remains to perfect a multiple contact transmitter, with which more battery can be used and a greater variation in current obtained, to increase the range of the wireless system. At present it is more of a curiosity than a device of commercial value,—still, it has some very promising features; It is at present being experimented

with in connection with deep sea fishing off the coast of Massachusetts. Alexander Graham Bell, the famous inventor of so much telephone apparatus, said in a recent newspaper interview, "I firmly believe the time will come when wires will not be necessary in telephoning."

The Panama Canal brings in another project in which the telephone plays an important part. Sending messengers over a low lying district, exposed to torrid heat as it is, would lead to certain delays in the dispatch of orders. An army of workers can not well be controlled by this means. And for this reason, the telephone will exert its good influence in causing this great groove in the earth's surface, which will connect the Atlantic and the Pacific, to be controlled by one master mind, and best carried to a rapid and efficient culmination. The importance of the telephone is such that through it the future Panama Canal will be hastened to a completion which might otherwise have been long delayed.

Long distance telephony is advancing by leaps and bounds. To converse by use of the telephone over a distance of 1,100 miles, seems a remarkable feat, yet this has been done between London and Rome. The longest distance for effective telephoning from London was heretofore to Marseilles, a distance of 800 miles.

The new steamship La Provence of the French Line has a telephone system far superior to any other ocean liner. In all there are four distinct systems:—the navigating or marine system, the executive system, the cabin system, and several direct circuits used for intercommunication between the navigating and engine stations within the interior of the vessel. Not only does the navigation of the ship depend in some part upon the telephone, but the personal convenience to the passengers is a source of much enjoyment. The cabin system is similar to the systems now in use in nearly all the large hotels in the world.

Train dispatching by telephone is pushing out the telegraph on many railroads in the United States. The Union Pacific has commenced the construction of a telephone line from Chicago to San Francisco. The telephone is considered a surer means of communication than the telegraph and no doubt in its use for despatching trains, many serious and fatal accidents will be avoided.

These are a few of the many uses of the telephone, and the varied and many uses to which it can and will be put in the future are nearly without limit.

It has been proved beyond a doubt, the handiest and most useful of all inventions in all phases of life of the last fifty years, and may its uses multiply in the future as in the past.

ALUMNI NOTES.

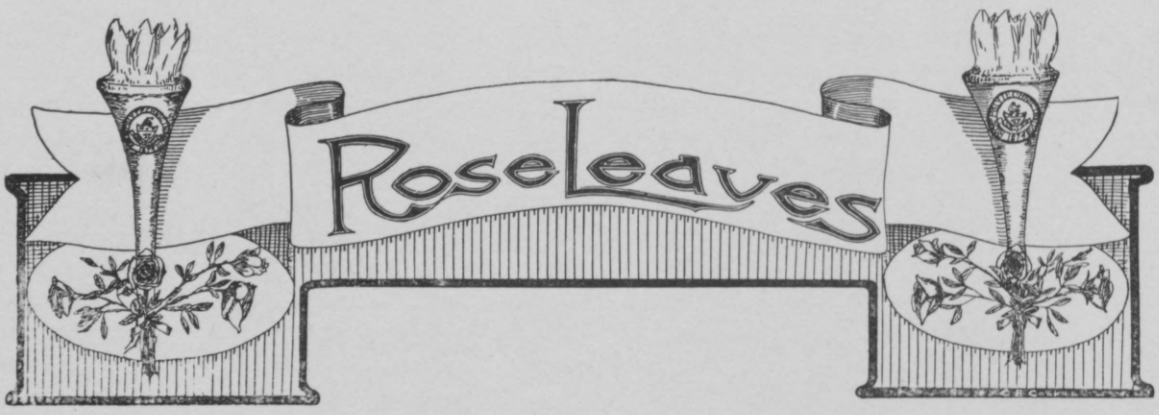
K. E. Voorhees, '98, is now located at Sunburst, N. C. as mechanical engineer for the Champion Coated Paper Co. Until recently Mr. Voorhees was with the Tennessee Copper Co. at Copperhill, Tenn.

On November 6, W. H. Hazard, '04, was married to Miss Agnes May More at Avalon, Wis. After Jan. 1, Mr. and Mrs. Hazard will be at home at Beloit, Wis., where Mr. Hazard is connected with the Fairbanks-Morse Manufacturing Co.

G. H. Likert, '99, has been promoted from Ass't. Master Mechanic of the Union Pacific R. R. at Cheyenne, Wyo., to Master Mechanic. Mr. Likert's new location is at Denver, Colo.

R. N. Miller, '01, announces that he has opened an office for the practice of law at the United States Trust Building in Louisville, Ky. After teaching several years in the Louisville Male High School, Mr. Miller entered the Harvard Law School from which he has been graduated.

S. J. Kidder, '00, who directed the enlarging of the Tonopah Mining Company's mill at Tonopah, Nevada, is now with the Desert Power & Mill Co., of Millers, Nevada, in charge of the mill there. This company is also under the control of the Tonopah Mining Co.



RAILWAY ACCIDENTS AND THE NEED OF GREATER SAFETY TO THE TRAVELING PUBLIC.

By A. A. BAREUTHER, '10.

FEW, out of the many millions of people that travel, reclined in cushioned seats of finely equipped coaches, on the railways of this country, realize, or even think, of the great responsibilities and work, necessarily involved, resting on the shoulders of comparatively few men, attached to the system of management of our great railroads. These responsibilities vary of course, as in other lines of commercial life, but in no other line where so many human lives are concerned, are the responsibilities greater than those of a train dispatcher and the men who work directly under him, in the control of the numerous trains which carry the traveling public and the commercial products of the day.

The duties of a train dispatcher are many. First of all, he must thoroughly know the rules and laws regulating the movement of trains, so that he is an authority, and can readily decide and rightly advise those who look to him for instructions in any question that may arise. The method of handling trains by telegraphic orders sent from one point on a division of a railroad varying in length from fifty to five hundred miles, according to the amount of business handled, is simple, and yet, when trains are numerous and are frequently delayed, it becomes very complicated. It is at this time that the train dispatcher must have the situation well in hand and avoid any movements being made unless they are understood by everyone concerned in carrying out his orders.

Accidents frequently occur through the misinterpretation of train orders, so it is highly important that they be constructed in such a way that there can be no misunderstanding by those who must carry them out. The standard code of rules and instructions now in use by most of our great systems has very much simplified the wording and meaning of telegraphic train orders, so that anyone, with train service training, can understand them. And still when a great many movements (and by movements is meant the various relations or meeting points between any number of trains) are included in one order, there is often a misunderstanding, or some part of the order is overlooked by those who are expected to carry it out.

Train dispatchers must be well acquainted with the condition of the track, grades, auxiliary tracks, pulling capacity of engines at every point on road, equipment, etc., to enable them to handle trains most successfully and safely. We can see from this that the work of these men must be performed with judgment, skill, and a constant watchfulness of not only his own work but also the work of those under him.

Operators, engineers and train men must share

with the train dispatchers these responsibilities; the operators by close attention to duty and the deliverance of every order received, to trains as directed, and the engineer and trainmen by the faithful execution of these orders. In fact, no one directly concerned with the operating and movement of trains and the keeping of track and equipment in good order, can fail in their duty without causing or increasing the possibilities of accidents.

Now that we have specified in a brief way the duties of those connected with the handling of trains, we will next consider train accidents and their causes. Some accidents, and often serious ones in which the fatality of life is great, have occurred from causes over which man has no control, such as landslides, the weakening of bridges by heavy rains, and by broken rails. As we all know, the number of train accidents in this country is enormously large, statistics showing that in the quarter ending March 31st, 1906, there were 3,495 collisions and derailments, and that of this number 289 collisions and 167 derailments affected passenger trains. All railway accidents in this time resulted in the immediate death of about 945 people, and probably four or five times as many injuries. Compared with the total number of people carried by all the railroads of this country, the fatalities do not appear so great, and yet there has been an increase each year, notwithstanding the great many safety railway appliances that have been in use for some years and the adoption of new methods and appliances for safety which the railways take up as soon as their applicability is ascertained.

The block system, which more than all other safety appliances and means has greatly increased the factor of safety, and which is gradually being adopted by all our great systems, eventually will be required by the passage of a law making the adoption of the block system a necessity. One of the important acts of the last session of Congress was its instructions to the Interstate Commerce commissioner to investigate the use of the block system for railroads so that a suitable law calling for its early adoption might be passed.

For the information of those who are not familiar with the term "block system," it may be well to explain what is meant by a block system and its use. A block is a specified piece of track between two points, usually stations, which no two trains running in either the same or opposing directions can enter or use at the same time, and which is governed at its extremities by the semaphore and signal called the block signals. Then a series of these blocks in operation is called a "block system." The block signals are usually handled directly by the operators except at times when special instructions are necessary ana then the operators and trains concerned are governed by instructions from the train despatcher.

A block of this kind which is absolute in force is a certain prevention of head-on or rear-end collisions, provided the operators, dispatchers or enginemen do not fail in their duty, as it is based on the principle that but one train shall occupy a block at any one time, or in other words, that there shall exist a definite space interval between any two trains whether they are running in the same or opposing directions on the same line of track.

The absolute block system as operated by European railways is hardly recognized by our roads as a certain solution for the prevention of accidents. Our rules are modified to such an extent that the value of its service is greatly decreased. One road may apply the use of the block on passenger trains only, while others will use the block on all trains, but will allow a following train to proceed from a block station after a certain period of time has elapsed, regardless of whether the train ahead has cleared the next block or not. Of course it must be understood that the absolute application of the block system is impracticable at times, particularly where only single track is operated, as it necessitates a great deal of delay and expense. The installation of a block system and the maintaining of it is necessarily a large expense and it requires double the force to operate it. The automatic electric block as operated on double track by some of our roads is a great

success, although maintained at a large expense and often resulting in many unnecessary delays usually due to weather conditions affecting the electric current,

The value of the block system is best shown by its results on the best European roads, where collisions seldom occur. In England, where nearly twice as many people are carried annually on the steam railways as in our own country, the fatalities and injuries, including both the traveling public and railroad employees, amount to less than one per cent. the number in this country. Of course it must be remembered that we have little double track in this country in comparison with England when total mileage is considered, and that our total mileage is five times as great as the mileage in England.

The point of perfect safety in railroad operation may never be reached. The absolute block system is a great step towards perfect safety, but as long as the human mind is liable to error there will be accidents, but by the adoption of the block system, interlocking and other appliances for safety, the number of accidents will be reduced to a minimum. Responsibility of errors does not always rest on the shoulders of one man, but accidents frequently occur by the neglect of duty of two or three men.

The method of controlling trains from a central train dispatcher's office by means of telegraphic orders delivered to the train crews through the operators has been in service for years and has been found wanting atleast in its ability to protect the lives of passengers and employees. It depends too much on the human element to attain that degree of faultless working which the tremendous issues at stake demand. Telegraphic orders are forgotten, trainmen read roughly the orders they receive or mistake their contents through careless writing. Occasionally operators fail to deliver train orders while there is the ever present danger that the train dispatcher, careful and conscientious as he may be, may make some fatal error in his work.

As has been said, the number of fatalities and injuries resulting from railway accidents in the country is enormously large and a great menace to the American people. We are reminded of the seriousness of this question when we read, that in the month just passed, two accidents occurred which resulted in the death of more than one hundred people. But surely these conditions cannot last long, and it is to be hoped that there will be a law passed in the next session of Congress bearing upon this question which will result in stricter regulation and make absolutely necessary more universal use of all appliances for safety.

YOUNG MEN'S CHRISTIAN ASSOCIATION.

The State Convention of the Young Men's Christian Associations of Indiana was held on November 22, 23, 24 and 25 at Ft. Wayne. G. M. Curry and C. W. Rich attended as delegates from the Rose Association. A report of the convention was given by these delegates at the regular convention meeting Friday evening, Dec. 7. Of the 261 delegates attending the convention, 119 were from the different college associations of the state.

A report recently issued by the Association shows some interesting statistics regarding the work last year and the work this Fall. An itemized budget of expenses and resources has been published also, giving a definite idea of the financial basis of the Association. Some men of the Institute have been surprised to learn that the Association maintains a budget above the proportion received from the Students' Council. Investigation reveals that this amount is proportionately a small per cent. of the total budget of $710.00. Last year the Alumni alone gave $175.00 toward the support of the Association work. The student pledges so far this year have amounted to $60.00.

STATEMENT FOR FALL OF 1906.

Bible Study—33 men enrollled. 3 Classes, 2 Systematic courses.

Membership—237 men in school. 56 members of the Association.

Religious Meetings—6 Regular Association Meetings. 18 average attendance.

Social—200 attended Fall Reception. 75 Personal calls.

Employment—3 men helped to earn way.

Finances—$100.00 from Student Council. $60.00 Student pledges. $75.00 Students' Hand-book,

New Students—Trains met during opening days. 100 men assisted in finding rooms. 56 letters to prospective students. 450 Hand-books published.

November 1, 1906.

THE SCIENTIFIC SOCIETY.

The first address of the year before the Scientific Society was given on November 24, by Prof. McCormick, on the subject of Coal Mine Surveying. About eighty men filled the physics recitation room to its capacity, and listened with interest.

Prof. McCormick divided the subject into two parts: the surface work and the underground work. The surface work includes the location of the corners of the property to be worked, with respect to the tipple, and the location of ponds, railroad rights of way, and other surface features which it is desirable not to undermine.

The proper orientation of the undeground survey is absolutely necessary. If the mine has but one shaft, two plumb-wires set on a line of known direction, are hung in the shaft. The line can then be obtained at the bottom. The method of placing these plumb-bobs was described in detail. If the mine has two shafts, a plumb-wire should be placed in each shaft, and the azimuth of the line connecting their points of support determined; an underground traverse between the two wires then has this line as its closing course, from which the azimuth of all other lines of the traverse becomes known. The time required for plumbing a shaft varies from one to three hours.

Prof. McCormick illustrated his description of the arrangement of the mine by blackboard diagrams, describing the parallel entries and breakthroughs, and the ventilation obtained by digging in this way. The cross-entries and rooms were also fully described.

The underground survey reduces to a matter of running lines in the entries and locating the rooms and break-throughs. The lines are held by spads in the cross-bars overhead, the stations being numbered from zero up. The compass-needle should be read at all changes of direction, as a check on the direction of the turn, as right and left are easily confused in the dark. The notes on the side rooms should be accompanied by sketches, and preferably kept in a book separate from the traverse notes. Measurements to the nearest tenth of a foot are accurate enough for all practical purposes.

The surveyor becomes an economic factor in keeping the entries straight. Miners left to themselves are apt to drive the entries according the cleavage of the coal, and make the entries crooked, which results in greater cost for driving entries and for haulage.

Every point in the mine is located with reference to some fixed point, by latitudes and departures, and the maps are drawn from this data.

CAMERA CLUB.

Prof. Peddle gave a very interesting lecture before the Camera Club on November 22, on the subject of lantern slides The kinds of plates to be used were spoken of, the method of working, materials and apparatus were described in detail, and a number of handy "wrinkles" were mentioned. The method of copying from the page of a book was described, and several slides made from originals of this kind were exhibited.

The Club has decided to inaugurate a series of photographic contests and the following rules governing such have been adopted.

RULES GOVERNING THE PRIZE COMPETITIONS OF THE CAMERA CLUB.

First, second and third prizes shall be awarded every month if possible, on pictures of two subjects of interest selected by the Club for the month stated.

One or more pictures of the same subject may be entered for competition. Competitors must be members of the Camera Club and in no case will pictures be considered for prizes which are not entirely the work of the competitor.

The following data shall accompany each picture:—

Kind of plate and developer used, date, time and length of exposure, stop used. and conditions of light.

A disinterested party shall be selected to award the prizes.

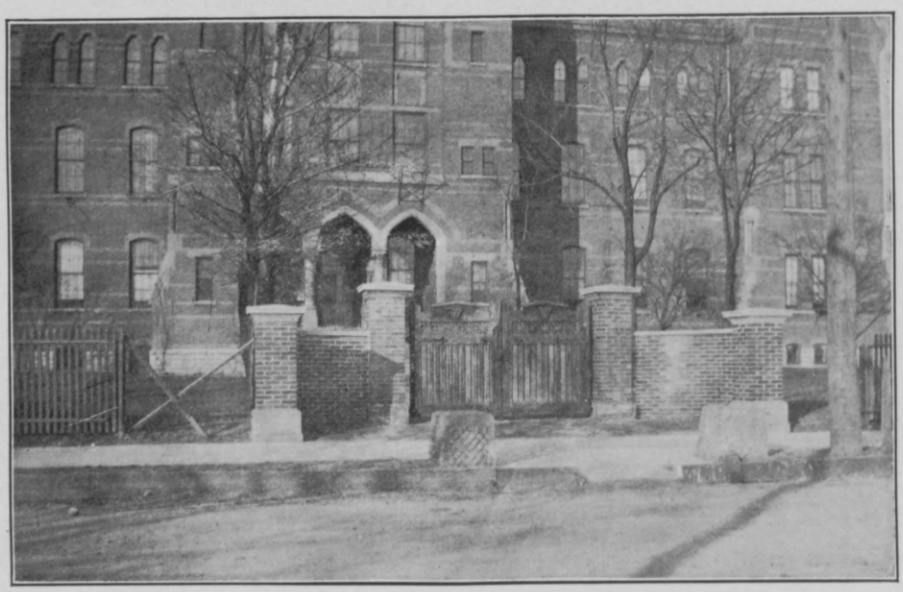
Pictures on which prizes are awarded shall become the property of the club and shall be exhibited in the Camera Club Case.

Subjects selected for November:—City Library and Wabash River Bridge. For December and January:—Rose Orphan's Home and The Entrance to Highland Lawn Cemetery.

Prizes for November—1st, Exposure Meter. 2nd, 8 oz. Graduate. 3d, Honorable Mention.

Prizes for Dec. and Jan.—1st, Extensible Album. 2nd, Thermometer. 3d, Honorable mention.

The result of this November competition was as follows: 1st prize—Wabash River Bridge—J. B. Shickel; 2d prize—City Library—E. G. Albin; Honorable Mention—Wabash River Bridge, R. L. Bond.



THE MEMORIAL OF '08. *Lindsley, Photo.*

THE JUNIOR MEMORIAL.

The front entrance to the Polytechnic grounds now appears as shown in the above picture, except that the fence has been replaced at either side of the gate postr. The original design for this improvement of the grounds was the work of H. W. Foltz, '86, though it was not followed in all details because of prohibitive cost. The portion of the work which constitutes the memorial of the class of '08 was done by the Modern Construction Co., of this city.

ANNUAL MEETING I. I. A. A.

The annual meeting of the Indiana Inter-collegiate Athletic Association was held Saturday morning, December 8, in Hotel Denison, Indianapolis. The meeting was called to order by President Draper of Notre Dame, and the following were present:

Vice-President W. G. Seaman, DePauw; Secretary G. C. Miller, Wabash; E. O. Howland, I. U.; M. J. Golden, Purdue, and H. M. Shickel, Rose.

Before proceeding with the business of the meeting, Prof. G. W. Benton of Shortridge; Prof. J. T. Giles, of Marion High School, and Prof. L. D. Coffman of Connersville High School appeared before the convention, coming from the Indiana High School Athletic Association, and asking for co-operation in the control of athletics. They presented the following resolution, which was adopted unanimously upon motion by DePauw, and second by Rose, with little or no debate.

No student leaving a High School before graduation shall be eligible to participate in athletics during his first year in college unless he presents a certificate from his High School principal showing that he was eligible to to engage in athletics under I. H. S. A. A. rules at the time of leaving High School.

This resolution will come up as an amendment to the constitution at the next annual meeting, and notice is considered given of the fact.

The minutes of the last meeting were read and with a slight change approved. The results of last year's track and field meet (Purdue, May 26) were read and passed. No treasurer's report was received, but last year's treasurer Sutherland of Wabash was present, and explained affairs as follows: Clevenger of I. U. was installed treasurer at the meeting last year, but filed no bond. He made a demand for the moneys in the treasury, but the Wabash man refused to turn over the funds. It is supposed that Clevenger collected the dues from each of the members, but no assurance could be had, and the affair was left to the settlement of the delegate from Indiana and the one from Purdue, who is the incumbent. Mr. Clevenger left school suddenly, and it is thought that he is straight in his accounts with the Association. No blame attaches to him or to his University other than his neglect to file the required bond.

It being Poly's time to have charge of the annual State field and track meet, it was formally tendered to our school upon request.

A resolution was adopted upon suggestion of Rose, and put by DePauw, making basket ball a recognized college sport, and extending jurisdiction as to rules and eligibility so as to cover games played by the teams representing the different schools.

The announced amendment to the constitution which would bar Freshmen from teams was next taken up, and the representatives were called upon in turn to present their views. Notre Dame, Purdue, and Indiana, all of whom are accounted with the Big Nine, have not been playing first year men; Wabash and Rose argued that such a rule would work havoc with teams, and Prof. Seaman spoke at some length, for and against, saying that while it might clarify athletics somewhat, and that it might make men slower to change from one school to another, on the whole it was unnecessary. Prof Golden then defended the amendment and asked merely that the question be not settled this year, but remain open for further thought and discussion. This was granted by unanimous consent, and no further notice is required for the amendment to pass next year if the schools are ready for it.

Another amendment was adopted upon suggestion from Purdue; Art. II. Section 1 Rule 3, reading:

"No student shall participate in baseball, football, and track athletics upon the teams of any college or colleges more than four years in the aggregate, and any member of a college team who plays during any part of an inter-collegiate football (or baseball) game does thereby participate in that sport for the year. The first three games of inter-collegiate football in each season shall not count as participation,"

was changed by the omission of the last sentence.

After formally allowing the expenses of the delegates, and in addition the expenses and bond fee of Mr. Sutherland amounting all told to $36.45, the meeting adjourned.

A general unanimity of opinion, and desire to be fair and to be treated fairly prevailed throughout the meeting, and such gatherings cannot but be a benefit to athletics, and to the mutual good faith and good fellowship which are coming more and more to manifest themselves in all inter-collegiate dealings and interminglings.

ANNUAL MEETING I. C. A. L.

The following report of the annual meeting of the I. C. A. L. representatives, which was held at Indianapolis on December 8th, is handed in by Mr. F. P. Mooney, the Rose delegate to the conference.

At the annual meeting of the Indiana Collegiate Athletic League, the following business was transacted.

Meeting called to order by Mr. Grover Grimes (Pres.) of Earlham.

The minutes of the previous meeting were read and approved. Also all reports on the table were approved.

The League next listened to a delegation representing the Indiana High School Athletic Association, which was composed of the following gentlemen: Mr. G. W. Benton, Secretary; Mr. L. D. Coffmann, Treasurer.

They spoke at length on the elegibility of a student who has quit high school dishonorably being allowed to play on a college team wherever he enters.

The trouble which these students bring upon the college and high school was made evident by these gentlemen and resulted in the I. C. A. L. adopting a resolution bearing on the matter identical with the one adopted by the I. I. A. A., which is given printed elsewhere in this issue.

The place of the annual I. C. A. L. field meet was decided to be Crawfordsville, Ind.

The date of I. A. C. L. field meet was changed so as to come one week earlier then the regular date.

A motion by F. P. Mooney of Rose that Butler be allowed to schedule games with the I. C. A. L. colleges was carried.

Mr. J. P. Kimmel of I. S. N. S. moved that he and F. P. Mooney be continued on the constitution committee and have 600 copies made of the new constitution and see that each member receive its share. Motion carried.

A motion by F. P. Mooney of Rose to bar the University of Cincinnati from scheduling games with this League was carried.

All new amendments were adopted by the League.

An exception was made in Indiana Faculty Athletic Conference Rules which were adopted as Art. IX of the I. C. A. L. constitution. The change was made in Rule 4, which in its new form will read, "No student having been a member of any college athletic team during any year, and having been in attendance less than one college half year, shall be permitted to play in any inter-collegiate contest thereafter until he shall have been in attendance six (6) consecutive calendar months. The above applying to all colleges of the I. C. A. L. except Indiana State Normal School." If the Indiana State Normal takes advantage of this rule as it now reads it will have to be shown that the men playing under that rule have been school teachers for a period of six (6) consecutive calendar months before entering the school.

The following officers were elected to serve for the ensuing year:

F. P. Mooney—Rose, President.

A. J. Whallon—Hanover, Vice-President.

Prof. J. P. Kimmel—I. S. N. S., Secretary.

W. B. Douglas—Franklin, Treasurer.

Finance Committee—S. W. Thoms, Wabash, Chairman; Grover Grimes, Earlham.

The books of the Treasurer were audited and found correct. Meeting adjourned.

The Sophomore Class held a meeting on Dec. 7th, for the purpose of electing an editorial and business staff for the Modulus of '08. The lightning struck as follows:

E. M. Brennan . . . . . Editor-in-Chief
R. L. Smith . . . . . Assistant Editor
Jas. A Shepard . . . . . Business Manager
Jas. N. Johnson . . . . Ass't Bus Manager
Wm. H. Rockwood . . . . . Artist

W. H. Uhl, '02, has been appointed Assistant Engineer of Tests on the Union Pacific Railroad, with office at Omaha, Neb. He was formerly inspector of locomotives and cars for the same company.

C. H. Jumper, '02, is now with A. D. Linte, chemical expert and engineer of Brocton, Mass. Formerly Mr. Jumper was connected with the testing department of the Harriman System at Omaha, Neb.

The following Alumni have recently visited the Institute:

N. J. Klinger, '96, of Dayton Ohio.

H. J. McDargh, '96, of Dayton, Ohio.

J. C. Young, '92, of Saginaw, Mich,

VANDERBILT, 33; ROSE, 0.

The Rose team more than pleased the fans at home when they played the game of the year against Vanderbilt and the score of 33 to 0 means a very creditable showing considering the standing Vanderbilt has in the Big Nine class. According to them Rose gave them the hardest workout of any team except Michigan. Their line was often broken through for good gains and several times during the first half, their goal line came near being crossed.

When play started everything was Vanderbilt and rooters were plenty but after about five minutes of play, there was a surprised and hushed-up bunch of rooters. The weather which was sultry, after the first half began to tell on the Rose team and this accounts for the score.

Strecker and Backman for Rose played brilliant games, frequently breaking through the line and downing the men before the plays got started.

LINE UP.

VANDERBILT.	POSITION.	ROSE.
V. Blake	L. E.	Taylor
Pritchard	L. T.	Backman
McLean	L. G.	Standau
Stone	C.	Schmidt
Chorn	R. G.	Scharpenberg
Noel	R. T.	Strecker
B. Blake	R. E.	Pritchard
Costen	Q. B.	Douthett
D. Blake	L. H.	Whitlock
Craig	R. H.	Hadley
Manier	F. B.	Lammers

Referee—Walker, Virginia.
Umpire—Elgin, U. of N.
Time of halves—25 and 15 minutes.

MILLIKIN, 6; ROSE, 5.

For the first time in football, James Millikin defeated Rose at Decatur, Nov. 24. The game should at least have been a tie and but for a hasty attempt at goal the score would have been 6–6. For the most part, Rose showed superiority over her opponents by her well executed forward passes and end runs.

All during the first half, punts and forward passes were used but neither side scored, though Poly came as near as five inches when with the ball in our possession, time was called.

In the second half, Strecker's men played hard and fast and after getting within 20 yards of the goal, on a fake play Douthett took the ball around end for the first score. Strecker failed at goal.

Millikin's score came from line bucks, aided by a 15-yd. penalty.

In the last five minutes, Rose played hard to make another score but the score stood 6 to 5 when time was up.

LINE UP.

ROSE.	POSITION.	MILLIKIN.
Taylor	R. E.	Stocks
Backman	L. T.	Dunham
Standau	L. G.	Please
Schmidt	C.	Hill
Scharpenburg	R. G.	Bell
Strecker	R. T.	Jones
Pritchard	R. E.	McDavid
Douthett	Q. B.	Wilson
Whitlock	L. H. B.	Richmond
Hadley	R. H. B.	Hamilton
Lammers	F. B.	Moore

Referee—J. A. Brown.
Umpire—F. R. Wiley.

SENIORS, 0; JUNIORS, 6.

The second game of the inter-class series resulted in a victory for the Juniors by a score of 6 to 0.

The game started by Miner's kicking off to the Juniors, the ball being downed on the 15-yd. line. Play was fast and the two teams made gains back and forth about the center of the field and it was nearly twelve minutes before Cannon, '08, was sent over for the first count, the result of some costly fumbles by the Seniors. The remaining few minutes of the half, which was shortened considerably, proved too little time for either side to make headway and the whistle found the ball near the middle of the field.

The second half was played, for the most part, in the dark and line plays and end runs were almost wholly resorted to but neither side scored and the ball was midway between the posts when time was called.

LINE UP.

'07.	POSITION.	'08.
Orr	R. E.	Beauchamp
O'Loughlin / Post	R. T.	Freers
Andrick / McKenna	R. G	Sievers
McDaniel	C	Corson
Bond	L. G.	Nourse
Bogran	L. T.	Cannon
Cash	L. E.	Uhl
Kelley	Q. B.	Dodge
Austin	R. H. B.	Johnson
Whitecotton	L. H. B.	Bernhardt
Miner	F. B.	Reiss

Referee—Badenoch.

JUNIORS, 11; SOPHOMORES, 0.

On Monday, Nov. 26, the Junior team took the class football honors from the Sophomores by a score of 11 to 0. The play was fast on both sides, but the Sophomore line was weak, and the gains the '09 team made were on punts. Trick plays and double passes were used effectively and often by the Juniors, which with a strong line, accounted for their victory. Toward the close of the game, darkness caused costly errors, so that neither side was able to score in the second half.

'09 kicked off, Dodge returning the ball to the 35-yd. line. '08 then advanced the ball by gains of from 5 to 20 yards, Reiss making a touchdown and kicking goal, making the score 6 to 0 for the first seven minutes of play.

Crumley brought the ball back to '09's 29-yd, line from '08's kick-off, but '09 lost it on a fumble and Cannon carried it over the line for another touchdown. Time of playing, eight minutes.

'09 kicked off, and obtained the ball again from Crumley's punt, after which it went steadily toward the '09 goal, until time was called with it twelve yards from the posts.

Johnston kicked off for '08, the ball rolling behind '09's goal posts. It was brought out and from this time most of the gains were made by punts. Darkness prevented any very scientific playing. The half ended with the ball on '08's 20-yd. line.

LINE UP.

'08	POSITION.	'08
Uhl	L. E.	Levi
Cannon	L. T.	Tyler
Nourse	L. G.	Darst
Corson	C.	Piggott
Sievers	R. G.	Tuthill
Freers	R. T.	Smith
Beauchamp	R. E.	Montgomery
Dodge (capt.)	Q. B.	Curry (capt.)
Bernhardt	L. H.	Buckley, Holden
Johnston	R. H.	Adams
Reiss	F. B.	Crumley

Times of halves—20 and 15 minutes.
Referee—1st half, Cash; 2nd half, Miner.
Umpire—1st half, Miner; 2nd half, Cash.
Timekeeper—Mooney.
Head Linesman—Whitlock.

With the Millikin game closed another period of football history at Rose.

There have been seven games played and of these five have been on foreign grounds and five have been defeats. The schedule as a whole has been a little harder than usual, this being the first year for a Rose football team to meet Wabash and Vanderbilt.

The material for the team this year was better than that afforded last year when the team

brought down the championship of the secondary colleges of Indiana, but the team seemed unable until the season was almost over to acquaint themselves with the new rules.

The season opened at home with the E. I. S. N. and the final score was 0–0. This was followed by Earlham, also on the Campus. This game was not won by line bucks, end runs or forward passes but solely by punts. Score 5–0, the five points going to Earlham. These two games were to satisfy the thirst for varsity football at Rose. Then followed a defeat at Wabash, 26–0. This was breaking into faster company than we had been used to and consequently the score was not much of a disappointment. The team then played Culver in about three inches of mud and water and lost to them, 22 to 0.

Then came the game at Muncie against DePauw when Poly won on a whirlwind finish by a 10 to 9 score and incidentally casting sorrow over the Greencastle rooters who thought the game was theirs. When the team left for the Vanderbilt game, there were many guesses on the outcome but when the score, Vanderbilt 33, Rose 0, came back everybody wore "the smile that would not come off," for several days, for it was really a very creditable showing considering the scores Vanderbilt made against Chicago, Carlisle and others.

The Franklin game to which all the school looked to even up on scores was cancelled and the team took a rest on Nov. 17. Then followed the closing game with James Millikin and the football season of 1906 was history.

By having practically all of the varsity games away from home, the interclass games were arranged to satisfy the desire for football. The first game was between the two lower classes and resulted in a victory for the '09's. The Juniors, who had organized their team last year immediately challenged the Seniors to a game. The latter accepted and then began to look around for a team. After about ten days practice, the Seniors were defeated 6 to 0. Then in order to decide the school championship, the Juniors and Sophs met for the last game, the Juniors winning the last of the series by a score of 11 to 0.

Attention is being turned to basket ball now, since the close of the football season, and several who have had work all fall on the gridiron will continue their training indoors either at basket ball or base ball, which starts this month. The basket ball season for Rose will open about the first week of January. Games have been promised with Wabash, Purdue, Indiana, DePauw, with one at Earlham, and more will be arranged, making the schedule contain about fifteen games in all.

The season's success means much hard practice on account of breaking in new men. Besides Johnson and Freudenreich, who last year were varsity men, practically all the second team were graduates so this year there will be many places to fill, and with nobody sure of a berth on the team, it behooves every candidate to put in some hard work.

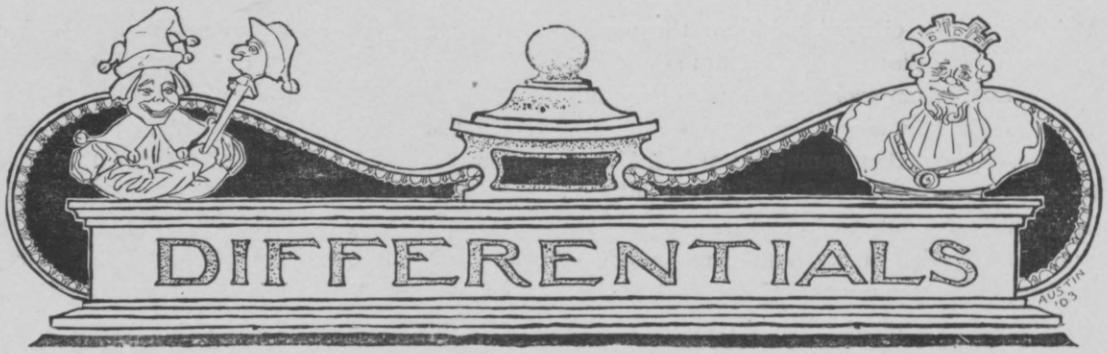
At a recent meeting of the Athletic Association, Donald McDaniel was elected baseball manager for the season of 1907, with John E. Bernhardt as assistant manager, and Paul Lindeman was chosen football manager for next year, with F. J. Frisz as assistant.

George T. McCormick was recently elected captain of the track team for the coming season, and C. L. Douthett captain of the football team for 1007.

T. D Jones, '89, is now located at Greeley, Colo as Chief Engineer of the Denver, Greeley, and Fort Collins Railroad Co.

G. H. Crain, '04, is now located in New York in the Whithall Bldg, 13 Bettery Place, having been transferred from Yonkers, N. Y.

W. R. Heick, '05, now with Westinghouse, Church, Kerr & Co , of New York, expects to return to Louisville, Ky., where he is to be connected with the McWilliams Engineering Co.



The two New Mexico beauties – Shephard and Shaw.

Amos D. Pritchard, '09, has been initiated into the P. I. E. S.

Montgomery (in Lab.): "What color participate will Ag NO_3 give with KOH?"

Sue Curry, '09: The Basket Ball schedule of this year seems to be a Miner matter.

Cardona, '10, absolutely refused to eat "dog" as served to him at the boarding house.

Bernard C. O'Brien, '09, was recently initiated into the M. E. P fraternity.

A Modulus dance is to be held during the last week before the holidays.

Bennett, (translating, Rudenz tritt ein in Ritterkleidung);—Rudenz enters in Knight clothes.

The local column of "THE TECHNIC" has a strong rival in the "*Senior Blowoff*" which is a weekly publication.

The Glee Club desires to announce that it is in dire need of a few more tenors. Come and have your voices tested.

Hummel: "I would hate to be in Doc Gray's place."

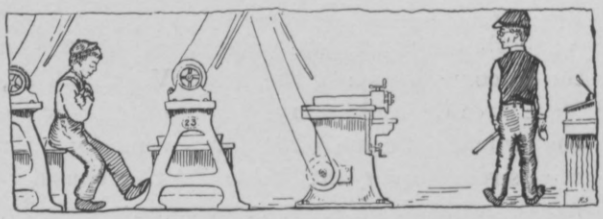
Sproull: "Why?"

Hummel; "Because he is so little."

A. W. Homberger, instructor in Chemistry has been initiated into the A. T. O. fraternity.

Duke (speaking of frequency): "How many flickers do you have to see before you can't see a flicker?"

Jo (to Thermo. class): "If we meet again, take to article 56. I don't care if we never meet again. Class excused."



J. H. Johnston—"Mr. Logan, I'd like to know how my time stands."

Logan—"Well, its been mostly sitting."

Friend: In what course does your son expect to graduate?

Father: "In the course of time, I expect.—*The Fulcrum.*

Hath: If I can walk 5t feet in t seconds, how many feet can I walk in one second.

Kelso, '08: You can walk one foot in one second.

Hath: No, that isn't fast enough.

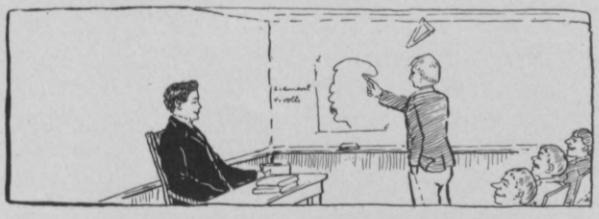
Kelso: Well then, you will have to run.

Prof. F. C. Wagner has returned home from Martinsville, Ind. where he has been taking treatment for sciatic rheumatism.

The orchestra is again under the direction of Hugh McGibney of Indianapolis and bids fair to be as good as ever. There is still room for new men, however.

Professor: Are the sides and angles of a hexagon always equal to each other?

Student: Yes, sir; unless you "sqush" it over.—*Review and Bulletin.*



Williams, as Boyd draws a dynamo characteristic curve: "You ought to be able to tell by looking at it what kind of a machine did that."

Pres. C. L. Mees has returned from a month's business trip in the east. During his absence Prof. Gray was in charge of affairs about the Institute.

McCormick, '08: Well, Doctor did you have a good time while on your trip?

Doc Mees: Yes.

McCormick: Well, so did we.

"There are eyes of blue," sang the lover under his lady's window
"There are black eyes too," hummed his rival, as he turned the corner.—*Ex.*

Frisz: Do you know Fatty Davidson?

Montie: Yes; but why did you want to know?

Frisz: Well, he reminds me of a camel.

Montie: I don't see how you make that out.

Frisz: Oh, he could go without eating for 40 days.

The way she hastened for the car
Was absolutely shocking.
She raised her skirts until I saw,
The checkers on her —— mittens.
—*The Crimson.*

The following exchanges have been received since the last issue of "THE TECHNIC:"

The Lincolnian:—Lincoln College.

Minnesota School Journal.

Student Life:—Utah Agricultural College.

The Franklin:—Franklin College.

The Review and Bulletin:—Southern University.

The Vedette:—Culver Military Academy.

Knox College Bulletin:—Knox College.

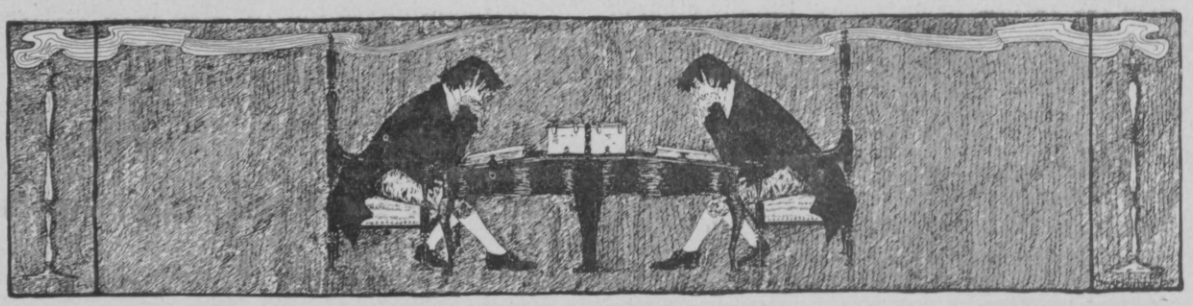
It would be advisable for all the students and especially the Freshmen to learn the college yells as published in the Y. M. C. A. hand-books, and learn them well. Nothing will bring forth the hoots and howls of an opposing team more than a poorly delivered yell. The words are easy enough to learn, but to this must be added a spirit of confidence in our own team, and an abundance of vigor. The basket-ball season will soon be on, so hesitate no longer.

Boyd—"What do they mean by "batter" on this abutment drawing?"

Gibbons—"O, batter is what they make pancakes of; that's what they call the concrete just after it's mixed."

Hath: Now let us imagine a ball to roll on the inner surface of a hollow sphere. What would be the least velocity of the ball at its lowest point in order to remain in contact with the surface during one revolution?

Gibbons: (from the rear of the room) Oh, Professor, I heard a better one than that.



REVIEWS

Steel vs. Wooden Ties.

The November issue of the *American Engineer and Railroad Journal* gives a comparison of wood and steel ties made by H. T. Porter, before the Railway Club of Pittsburg.

"The life of wood white oak ties under heavy traffic ranges from four years on sharp curves to eight or ten years on tangents. There is a wide difference in the durability of timber, even when it is the same kind taken from the same pack of woods. It is beyond the ability of inspector or trackman to select ties that will give the same duration of service. The tie begins to deteriorate from the time it is put in place; the rate of deterioration increasing until it becomes necessary to remove the tie. There is no trackwork that compensates fully for this deterioration, so you cannot maintain a condition equal to an all new tie track. The steel tie maintains its section, and the bed under the tie does not have to be disturbed on account of tie becoming soft, or on account of effective thickness of the tie becoming less due to rail or tie plate bedding into tie. The steel tie, up to failure, retains the same dimensions and efficiency, reducing the work required for surfacing and lining, and it is possible throughout the life of the tie to maintain track of the same excellence as with all new ties. Up to the present time we have only had one broken rail on steel ties, and the report attributes this break to a flaw in the rail. We have not used steel ties long enough to determine their life under our conditions, but an examination of a broken tie, after six years service, does not indicate that rusting under ordinary conditions should cause any anxiety. I somewhere read a statement that Mr. Post, chief engineer of the Netherland State Railroad, found that ties weighing 125 pounds laid in sand and gravel ballast, had decreased 8¾ pounds in 35 years, but were still good for 20 years' service."

The Decker Primary Cell.

The novelty of this cell, as pointed out in *Electro-chemical and Metallurgical Iudustry*, exists entirely in the mechanical construction. Is is a double fluid cell, with zinc plates in dilute sulphuric acid and graphite plates in a solution of sodium bichromate and sulphuric acid.

Each zinc plate and the dilute sulphuric acid surrounding it are contained in a flat porous cup. These cups are made of thin, unglazed earthenware plates shaped in steel moulds. After the cup is made, each surface is ground down very thin, so thin, in fact, that light shows through them. By placing the graphite plates directly against the outside walls of the cup the internal resistance of the cell is made very low.

The containing vessels are made of hard rubber and the electrolyte is supplied to the cells through pipes. A battery of several of these cells, pipes, etc. is put together in a compact mass with no loose joints of parts.

In tests made by Prof. Crocker, in which the cell was discharged from 1.9 to 1.3 volts, an output of 14.7 watt-hours per pound of total weight was found. A cell weighing 17 pounds gives 150 amp-hours at an average of about 1.7 volts, or

about 250 watt-hours, which is equivalent to one-third of a horse-power-hour.

The weight of zinc, sulphuric acid and sodium bichromate required to give 1 h.p.-hour in the Decker cell, assuming all materials to be thrown away after being used once, cost about 35 cents. The corresponding cost for the Lalande cell is $5.30. Since the Lalande cell has numerous applications, it is thought that the Decker cell will have an even broader field of usefulness, especially for automobiles and for lighting railway trains.

Alcohol for Engines.

The utilization of alcohol in internal combustion engines has been found feasible, by a number of investigators, by admitting it in liquid form directly over a disc valve, the liquid passing to the cylinder through a series of brass screens. With this method of fuel admission, engines of standard construction as arranged for operation with gasoline fuel, are said to start easily and run freely and without smoke or odor. Attempts toward the use of any form of carburettor, in which vapor of the alcohol is to be taken up by the air drawn into the cylinder, do not seem to have proved successful without some means of forced vaporization, such as heating or atomizing.—(*Engineering Record.*)

In tests of alcohol as fuel for internal combustion engines, a western gas engine manufacturer has found that while a much smoother running engine is the result, owing to the higher compression possible and the slower combustion rate with alcohol, the extravagant claims for low costs of operation are not to be realized in practice. The amount of fuel consumed under a wide range of operating conditions, was found to be practically the same per horse-power-hour as with gasoline for fuel, averaging for small units, about 1 gallon per horse-power for ten hours.—(*Engineering Record.*)

An Automatic Pumping Plant.

A recent number of the Railroad Gazette describes an automatic electric motor driven pumping plant in operation on the Lake Shore and Michigan Southern at South Bend, Indiana.

"The pumping outfit consists of two Worthington single-stage turbine pumps, each direct connected to a six-pole, 7½ h. p., three-phase, 440-volt General Electric Company induction motor. Two pumping sets are installed, so that in case one set fails, repairs can be made without shutting down the plant.

"The pumping house is a round brick structure erected at the top of a concrete lined wall. The floor is of concrete supported by I beams, and is ten feet below the level of the ground, and on this the pumps are erected. For keeping the pump room dry, four ventilating ducts are built into the wall of the pump house.

"Each pump discharges water through a 2½-inch pipe connecting with a 4-inch main which leads to the supply tank. This tank is located at the side of the tracks about 100 feet from the pumping station. The controlling device is arranged in the housing on the roof, the motors being started and stopped automatically by a small oil-switch operated by a float which has a vertical movement of about one foot. The difference in level in the tank corresponds to 3,000 gallons of water. This is the average amount taken by a locomotive and is replenished by the pumping set in about 25 minutes. The supply tank holds about 50,000 gallons and could supply fifteen locomotives within a few minutes, if necessary. However, such a heavy demand will probably never be made, and in actual practice the pumps stand idle the greater part of the time.

surrounds our Institute, for the light which comes from a sun red when visible, and the locally perverted Nature which places a soil of cinders and soot beneath our feet, are influences which do not tend to hold the mind by their charms, and the pages of text-books are restful to eyes weary with looking on the artificially painted face of Mother Earth.

The benefits of the cheap boarding house are also often underestimated. The viands to be had for two-and-a-half or two dollars a week are not of the kind that will lead to the gout or induce over-eating. If high thinking and plain living are companions, the diet of biscuits and molasses for breakfast, fried half-soles and kraut for dinner and bean porridge hot for supper, which comes only for the bottom-notch price, should produce a race from Indiana that will put ancient Greece and modern Germany to shame.

We rejoice with the Senior Class at the change of dates. The numerals which they adopted four years ago as the symbol of the time to which their hopes looked forward, have come as reality, and before another change, the persevering shall have obtained what they could from Rose, and gone to make records on other grounds, whither our best wishes shall accompany them.

AMONG the appurtenances which descend year by year to the successive committees of Ways and Means of THE TECHNIC, is a neat, thin little package of shadows, labeled "Honor of the Business Management, 19—," and one by one these shadows are doled to the incumbents of this thankless office. We say thankless, and the following brief financial statement will show why.

TECHNIC RECEIPTS FOR ACADEMIC YEAR 1905-06.

Advertisements	$468.00
Subscriptions	135.00
Student's Fund	321.00
Total	$924.00

It appears that about 50 per cent. of the total funds at the business manager's disposal is the income from advertisements. If any young man should take to the time-honored profession of the chevalier of industry, with a couple of horse-pistols and a "Money or your life!" it would probably have a serious and lasting effect on his character, and the action would be disapproved by his friends; but let him be appointed business manager of THE TECHNIC, and be expected to enter store after store and hold up the proprietors for advertisements, with a brazen face and a shameless tongue, and his friends say "Oh, what an honor!" They do not see the thin shadowyness of the title, and the wearing effect on the victim's conscience is praised as "business experience."

Now THE TECHNIC has no false modesty or any other kind, and begs, requests and dictates that Rose students remember its advertisers for good when they spend their money down town. This will lighten the burden on the business manager's conscience, gold-plate his brazen cheek and send the warm blood bounding through his large glad hand. When you go to buy an umbrella to keep the rain off or an overcoat to keep the cold out, remember THE TECHNIC. Whether your errand is to get a shave or to buy kodak supplies or roses for your young lady friend, remember THE TECHNIC. If the evening cigar or the midnight ham sandwich force themselves upon your attention, remember THE TECHNIC. If in the market for drafting instruments or the spectacles which they may ultimately make necessary, remember THE TECHNIC. If there is among us any man, who, when he wants a box of candy for some person unspecified, opens his heart and takes out a quarter, eyeing it with an expression which seems to say

"When we asunder part
It gives us inward pain,
But we shall still be joined in heart
And hope to meet again,"

hen we say, let him remember, remember THE tTECHNIC.

The incalculable effect, the psychic influence, of being thus mindful of our interests, depends not so much on the amount of money spent, as on the repetition of the act. In this case, we think every little bit helps. And so, fellow-students, being glad to give you this opportunity to acquire merit, we leave the matter to your consideration.

LIFTING MAGNETS.

By ARTHUR C. EASTWOOD, '98.

THE electro-magnet dates back to 1820, when Oersted discovered that the neighborhood of a conductor conveying an electric current possesses magnetic properties. This discovery was followed by the experiments and deductions of Sturgeon, Henry, Joule, and others, and later by the mathematical researches of Maxwell, Hopkinson, Ewing, and other scientific investigators.

The properties of the electro-magnet with which we are here concerned consist in the ability of the magnet to attract and hold particles of iron and steel when an electric current is passed through the magnetizing winding and to release the attached load when the flow of electric current is interrupted. These properties of the electro-magnet were early discovered, and, since 1825 at least, have formed the subject of many interesting and instructive laboratory experiments, and of many useful practical applications as well. Among the latter may be mentioned the electro-magnetic telegraph, the earlier forms of electric motors, and, with slight modifications, the telephone receiver and the modern electric motor. In all of these cases the electro-magnet acts invariably upon a given armature. In the lifting magnet, however, while the same magnetic properties are made use of, the armature to be attached and held by the magnet is variable, consisting of the load to be lifted, and this constitutes a very essential difference between the lifting magnet and other forms of electro-magnets, as will be presently seen.

Mr. S. T. Wellman, a pioneer in the manufac-

Fig. 1.—A Lifting Magnet handling Wire Scrap at the Newburg Steel Works, Newburg, Ohio.

* Reprinted by permisson from *Cassier's Magazine*, Dec. 1906.

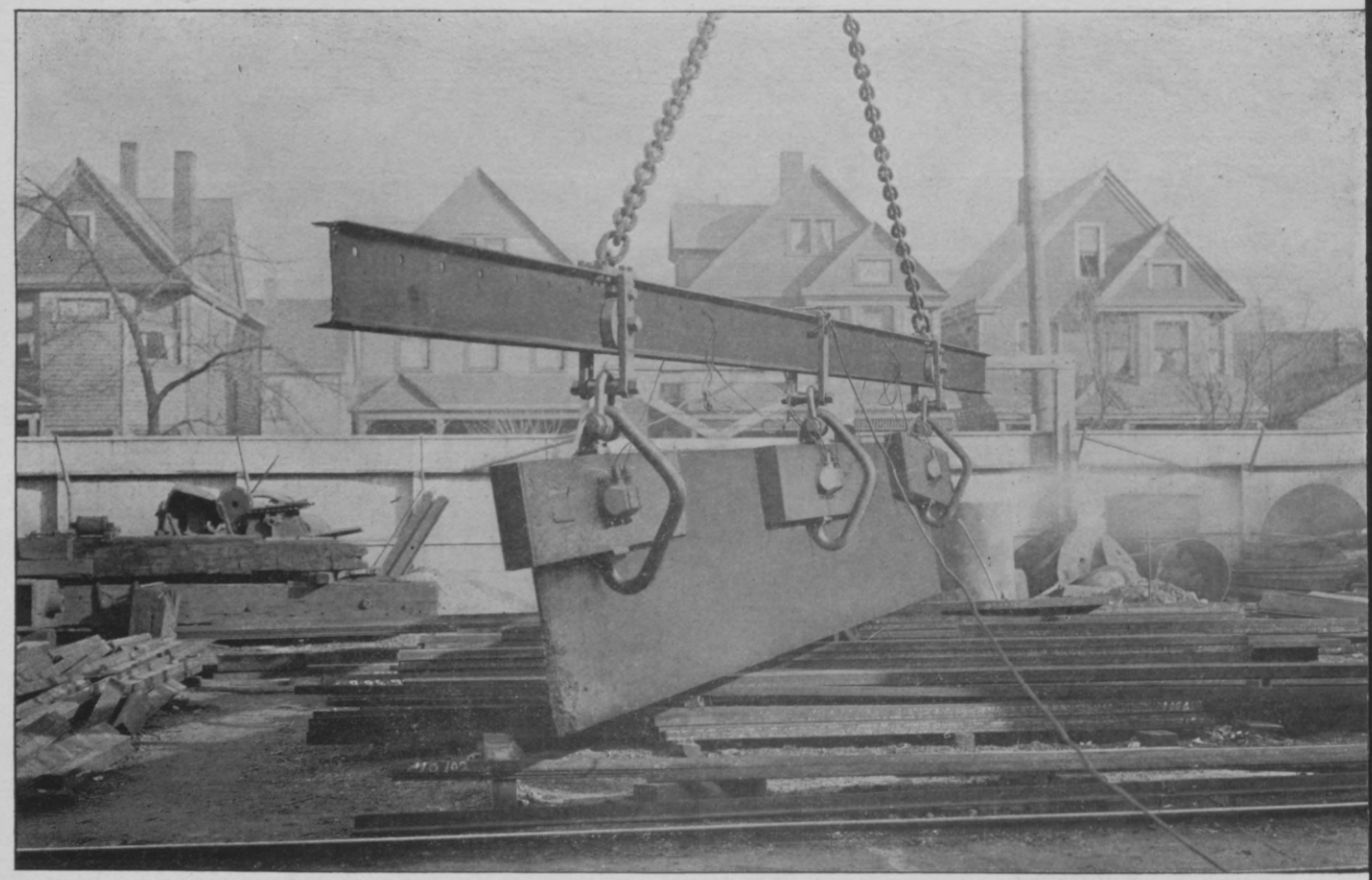


Fig. 2.—Handling Armor Plate with Lifting Magnets made by the Electric Controller and Supply Company, Cleveland, Ohio, U.S.A.

ture of open-hearth steel in America, was one of the first to grasp the possibilities of the electro-magnet as a ready means of attracting and holding iron and steel products while being lifted and transported by cranes and similar labor-saving machines.

The lifting of long, thin steel plates by means of slings and hooks had always proved a tedious and difficult matter. The plates had to be pried up in order that the hoisting taekle could be attached, or spacing blocks must be left between the plates when piled horizontally. When the plates were of considerable length and width a great deal of head-room was required, owing to the necessary spread of the hoisting chains, and accidents were frequent, due to slipping of the hooks commonly used for grasping the plate.

To Mr. Wellman's mind, the electro-magnet offered an ideal remedy for these difficulties. What could be more ideal than to attach an electro-magnet to the hoisting tackle of the crane, lower the magnet upon the plate to be lifted, grasp it by the simple closure of an electric switch, convey it to the desired spot and release it by simply opening the switch?

The idea was so enticing that Mr. Wellman at once set about putting it into execution. The first magnet was built by a prominent manufacturer of electrical apparatus. When put in service, it lasted just long enough to demonstrate

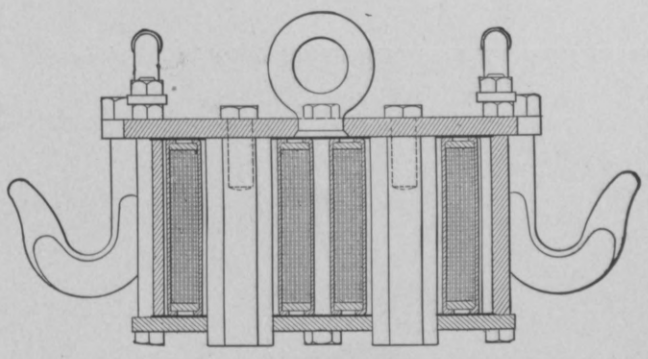


Fig. 3.—Vertical Section ofthe first distinctive Lifting Magnet, designed by S. T. Wellman, in 1895.

the possibilities of the lifting magnet. Although built by manufacturers accustomed to the design and construction of electro-magnets used in dynamos and motors, the magnetizing coils burned out so rapidly as to condemn it as a practical piece of apparatus. An electro-magnet dangling at the end of a hoisting chain, exposed to the weather, abrasion and rough handling, and, above all, subjected to the inductive discharge at high voltage which occurred each time the magnetizing circuit was opened to release the load, constituted a new article of manufacture which required special design. Mr. Wellman then undertook the design of an electro-magnet, which, as far as shown by the records of the United States Patent Office, was the first distinctive "lifting magnet." See Fig. 3.

In his design, Mr. Wellman provided means for entirely enclosing and protecting the magnetizing windings, a practice followed in all subsequent successful lifting magnets. Many magnets built in the early nineties in accordance with the original Wellman design are still doing good service.

The design of lifting magnets was later still further advanced by Mr. Eugene B. Clark, of the Illinois Steel Company. A typical magnet of the Clark type is shown in section in Fig. 6. This magnet is particularly adapted to lifting plates from a horizontal position and raising them edgewise so that they may be stored in vertical racks. The same type of magnet is used in shipyards for lifting steel plates from the ground and holding them while being attached to the vertical sides of ships. Fig. 2 illustrates a set of such magnets built by the Electric Controller and Supply Company, of

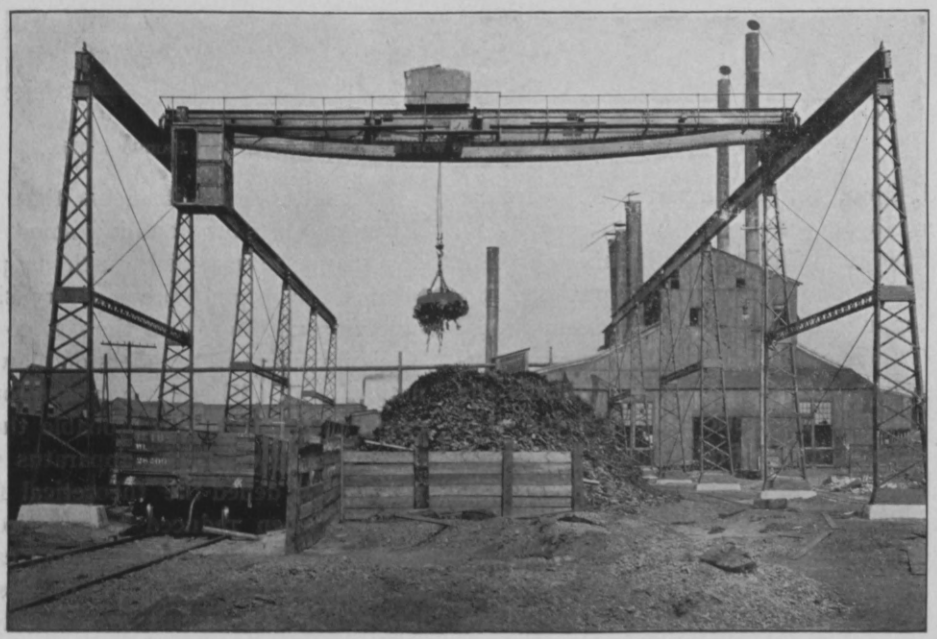


Fig. 4.—Magnet Unloading Scrap and Punchings from Cars to Stack piled in the yard of the Lake Erie Iron Co., Cleveland, Ohio.

Fig. 5.—Lifting Magnets Raising a Safe at the works of the Mosler Safe Co., Hamilton, Ohio.

Cleveland, Ohio, for the Imperial Shipyards at Yokohama, Japan.

In the handling of plates, a number of them may be lifted at one time and dropped one at a time in a manner so simple as to seem almost absurd. This is accomplished by simply opening and closing the switch which controls the magnet. As the magnetic flux dies out, the lowermost plate drops first, and if the switch be then closed, the remaining plates will be held by the magnet. The crane operator becomes familiar with the time element of the magnet after a few trials and can readily pick up half a dozen plates at one lift and distribute them, one at a time, in various cars or piles as desired.

At first thought, it seems that the design of lifting magnets for handling smooth, homogeneous magnetic material, such as plates, slabs, blooms, etc., should prove a very simple matter, involving nothing more than a consideration of elementary and well-understood laws of the magnetic circuit. This has not been found to be the case; and, in fact, it is probable that there is no other type of electrical apparatus which has so persistently defied the theoretical figures of the designer when reduced to practice. The magnetic circuit of the magnet proper can, of course, be made the subject of more or less exact calculation, but this circuit is normally incomplete,

and the resulting magnetization depends upon the character of the armature,—in other words, upon the load to be lifted.

A magnet which will lift a steel ingot weighing 5,000 pounds may not lift a long, thin plate weighing 500 pounds,—the armature is not only magnetically, but mechanically different. The thin plate, in addition to its small magnetic cross-section, is very flexible, and the parts of the plate which overhang the poles of the magnet introduce a bending moment tending to tear the plate from the poles of the magnet. In addition to this, when the plate is lifted, it will be set in vibration by the motion of the hoisting tackle, and this introduces a live load which must be taken care of by the magnet. The air-gap between the poles of the magnet and the load to be lifted (which depends on the smoothness of the surfaces, the presence or absence of scale, dust, snow, ice, etc.) is also an important factor, affecting both the total magnetic flux and its distribution. It may be noted also that available text-books on the subject of electro-magnets contain only a very meager amount of reliable data relating to the traction of such magnets.

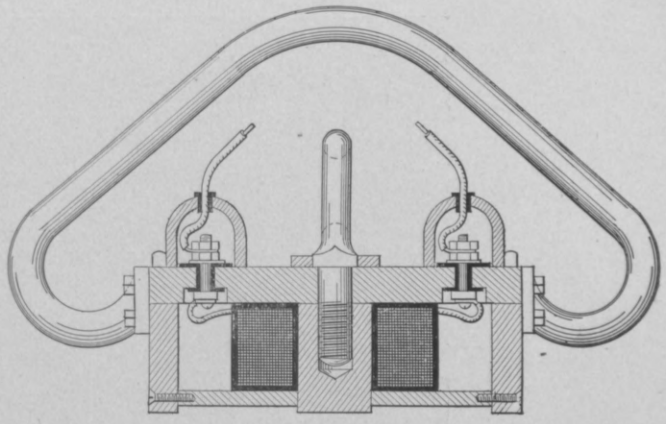


Fig. 6.—A Clark Lifting Magnet.

It must be evident, then, that the design of lifting magnets not only necessitates familiarity with the laws of the magnetic circuit, but also a thorough understanding of the conditions to be met and the ability to properly interpret these conditions in the design. This ability can be attained only by experiment and practical experience. Much of the success attained in the later

Fig. 7.—Handling Plates at the South Works, at South Chicago, of the Illinois Steel Company.

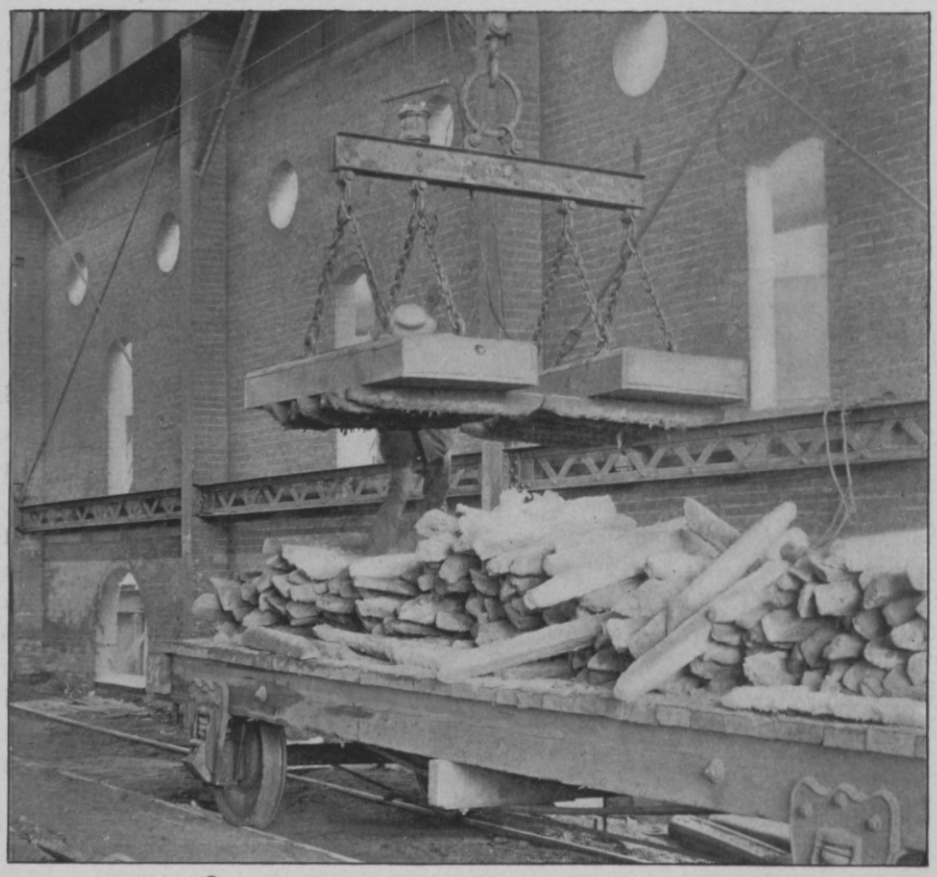


Fig. 9.—Handling Pig Iron Hot from the Sand in the Cast House of the Buffalo Union Furnace of the M. A. Hanna Co., at Buffalo, New York.

designs of such magnets is due to persistent experiment and the gaining of experience under operating conditions extending over a period of nearly ten years.

The Electric Controller and Supply Company, for example, at the outset constructed a testing machine with a capacity of 15,000 pounds for the purpose of obtaining experimental data. Since that time each magnet constructed has been tested under prescribed conditions, and its operation in actual service has been carefully followed. In view of the large number of magnets which have been built and tested in this way, abundant data have been secured for correlating theory and practice.

So far we have dealt only with magnets for handling what may be termed homogeneous magnetic material, such as plates, slabs, etc. Other problems remained to be solved in handling what may be termed "detached" material, such as scrap, pig-iron and the like. Until only a very few years ago it was considered quite out of the question to lift pig-iron economically by means of a magnet. A lifting magnet which would readily lift an ingot weighing 10,000 pounds would not lift a single pig weighing 100 pounds when lowered upon a pile of pig-iron.

Pig-iron, of course, possesses poor magnetic properties, owing to the impurities which it contains and to its more or less open physical structure. A pile of pigs presents an uneven surface, with large air-gaps between adjacent pigs. Necessarily these conditions demanded a much greater magnetizing force than that required for

lifting a steel ingot. The provision of what appeared to be the requisite amount of magnetizing force did not, however, produce the desired effect. The magnetic lines seemed to wander more or less aimlessly through the pile of iron in such scattered fashion that there was not a sufficient flux-density to produce the desired lift, and, owing to the unevenness of the surface of the pile, only a small portion of the pole area of the magnet secured contact with the metal to be lifted.

An attempt was made to overcome these difficulties by providing the magnet with movable pole pieces which would adjust themselves more or less to the irregular surface of the pile. A magnet of this character, designed by S. Piek, is shown in Fig. 11. As actually constructed, the Piek magnet was provided with seven central and twelve outer pole-pieces, which were loosely held in pockets in the central and outer poles of the magnet in such manner as to adjust themselves vertically to the load to be lifted. The idea appeared to be a good one, but the performance of the magnet, when actually constructed, was very disappointing. With a magnet weighing between eight and nine thousand pounds and requiring 50 amperes of current at 220 volts, only from six to eight pigs could be lifted from a miscellaneous pile. Excessive magnetic leakage, due to the long pole-pieces, appeared to counteract any advantage to be gained by adjustability; in fact, the pole pieces were

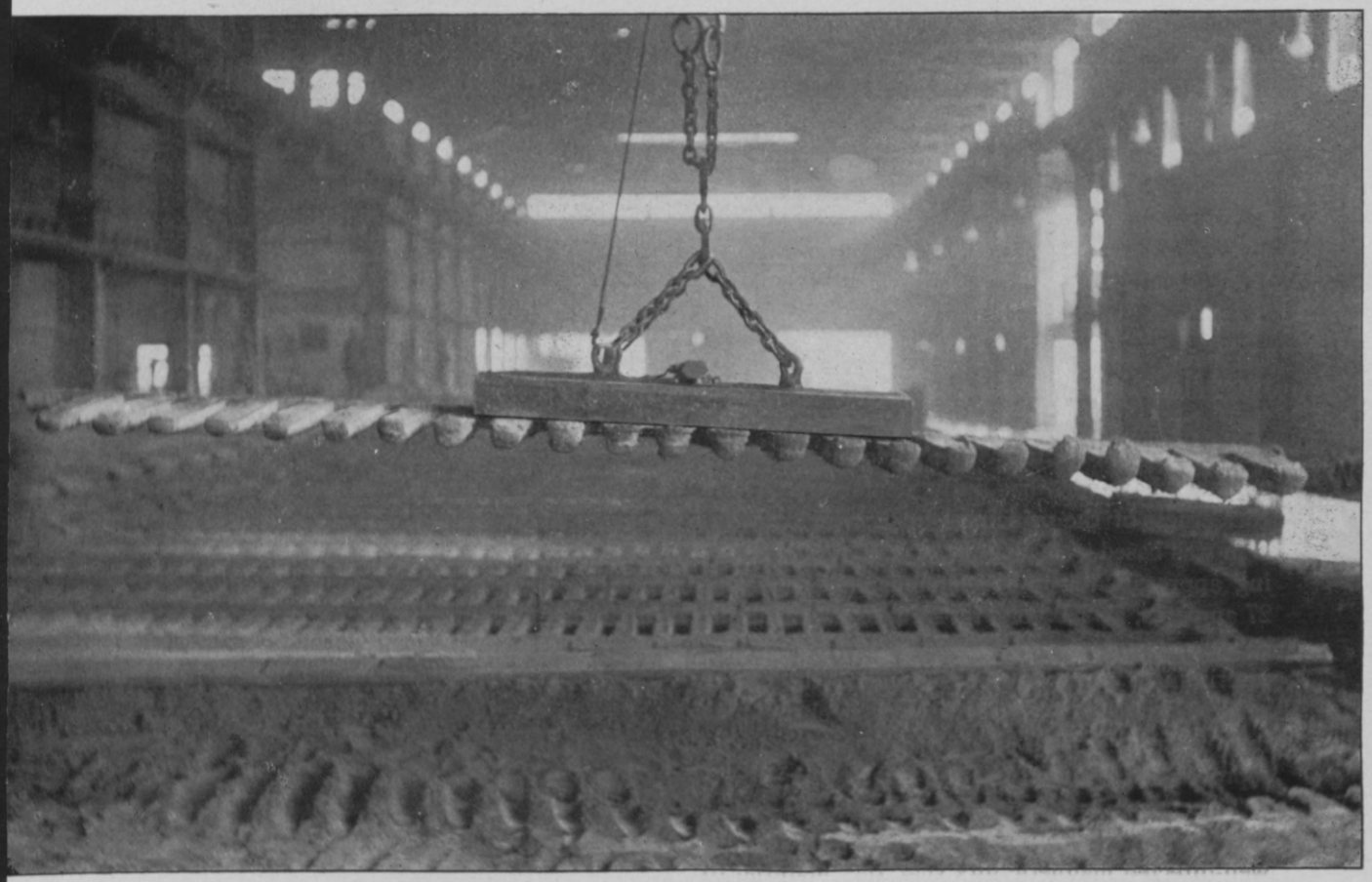


Fig 10.—A Magnet Lifting Sow and Pigs from the Sand in a Blast Furnace Cast House.

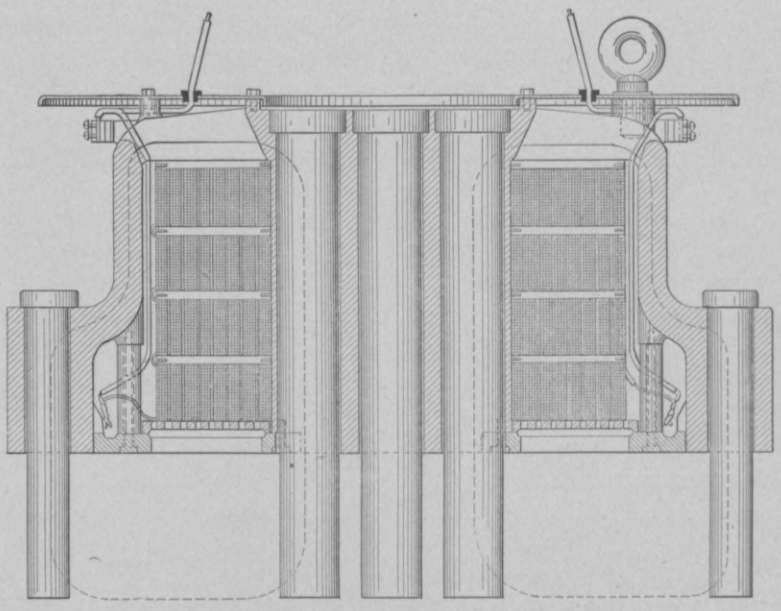


Fig. 11.—A Piek Magnet with Movable Pole Pieces.

gradually shortened, and better results were finally obtained by altogether discarding the outer adjustable poles.

The problem of designing a magnet for lifting pig-iron and other detached material was attacked by the writer in a radically different manner, and resulted in a magnet in which the central pole, instead of being adjustable toward the load to be lifted, was apparently carried away from the load. As shown in Fig. 12, the central pole face is located well above the outer annular pole. The design appears paradoxical, and, indeed, has been called idiotic. The performance of the magnet, however, has fully demonstrated the correctness of the principles upon which the design was based. A magnet of this type, weighing approximately 5,000 pounds and requiring 27 amperes, at 220 volts for full excitation, will lift from twenty to twenty-five pigs from an indiscriminate pile. Its performance in lifting other forms of detached iron and steel products may be judged from some of the photographic reproductions printed in these pages.

The primary idea underlying the design of this magnet was to produce such a dense and well-directed magnetic flux that the material to be lifted would rise to meet the poles of the magnet. In actual service an 80-pound pig of iron will jump vertically from 4 to 6 inches to attach itself to the centre pole. The load which is lifted forms not only the armature of the magnet, but a portion of the core as well. A greater weight of detached material is, therefore, required to satisfy the magnetic circuit than would be the case if the load formed merely the armature, so that the lifting capacity of the magnet is correspondingly increased.

In a magnet which is to handle from 300 to 800 tons of iron per day, it is evident that the design of the magnetic circuit is not the only thing to be considered. It is doubtful whether any other piece of electrical apparatus is called upon to operate under such extremely severe conditions. As previously mentioned, in the case of the magnet, shown in Fig. 12, pigs of

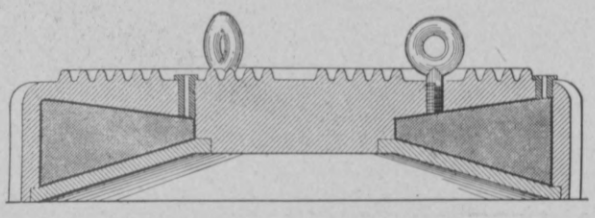


Fig 12.—The Eastwood Improved Lifting Magnet.

Fig. 13.—A Load of Machine Cast Pig Iron.

iron will jump several inches to attach themselves to the magnet. Only the very staunchest construction can withstand the daily hammering of 800 tons of such pigs, and, in addition to this, in rapid working, the magnet itself is frequently lowered with considerable force upon the material to be lifted. The methods of insulating the magnetized winding, holding it in place, providing for its expansion, and protecting it from moisture and from vibration, all require the most careful study and design; likewise, the effects of abrasion on the active face of the magnet must be provided for.

Now that these problems have all been successfully solved and the lifting magnet has been reduced to a practical and dependable device, it is being very rapidly adopted by manufacturers and users of iron and steel products, with the introduction of great savings in the cost of handling such materials.

In addition to the actual reductions in labor cost which may be effected by the use of lifting magnets, many indirect savings frequently result from their installation. For instance, on account of the increased speed at which material can be handled by a magnet, it frequently occurs that the installation of a magnet on a crane will permit of an increase of the plant and a corresponding increase in the amount of material to be handled without addition to the crane facilities.

With a crane and magnet, material can be economically piled to a height which would be out of the question where hand-labor is employed, hence, where only a restricted area is available for storing material, the value of this area may be largely increased by installing a a magnet.

A further labor-saving and novel application of lifting magnets consists in their use in connection with "skull-crackers" for breaking up

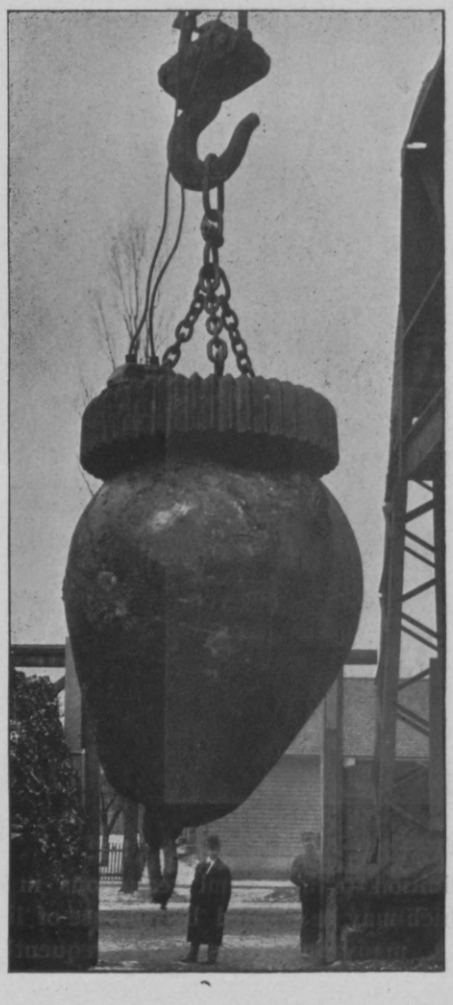


Fig. 14.—Liftihg a 12,000-lb. Skull Cracker with a Magnet.

"skulls" (the metal which clings to the lining of hot-metal ladles), imperfect castings, etc., which must be broken before it is possible to charge them into a furnace for remelting. This process was formerly performed by a mechanically operated "drop," consisting of a suitable crane or other hoisting device to which could be attached a drop-weight by means of a suitable latch. When the weight was raised to the desired height, the latch was tripped by means of a rope and the weight dropped upon the material to be broken.

The castings to be broken were usually dragged into position by the use of slings or chains. The drop-weight had a disagreeable habit of almost invariably glancing to one side in such a position that the latch could not again be attached without righting the ball, and the prying up of a more or less spherical ball, weighing from ten to twenty thousand pounds, requires much labor. The broken castings were usually gathered up and loaded into suitable cars or receptacles by hand. A number of laborers were required, and accidents from flying pieces of broken castings were frequent.

By the use of a lifting magnet all of this is altered. The castings to be broken are placed in position by the crane and magnet. A spherical drop-ball is employed, which is engaged by simply lowering the magnet upon it and closing a switch. When hoisted to a suitable height, the weight is released by opening the switch. The broken pieces of the "skulls" or castings are gathered up by the magnet and loaded into charging boxes. There is ordinarily no need of ground labor, the entire operation being conducted by the crane operator. By the use of a magnet, not only is the process of breaking castings greatly facilitated and cheapened, but the risk of accident is largely eliminated.

A few words as to the safety of handling material by means of magnets may not be amiss. Accidents due to the slipping and breaking of hooks, tongs and slings, which are commonly used for attaching loads to the hoisting tackle of cranes, are known to be of frequent occurrence. As a general proposition, if a lifting magnet is designed with a proper factor of safety, and if reasonable precaution is taken in installing the wiring supplying current in the magnet, there will be less danger of accident than is the case with any of the commonly used devices for attaching the load to the crane hook. This is particularly true in handling bulk material, such as pig-iron, for, aside from the relative safety of the magnet, by its use the presence of labor on the ground is largely dispensed with.

The only serious risk of dropping the load carried by a well-designed magnet lies in the

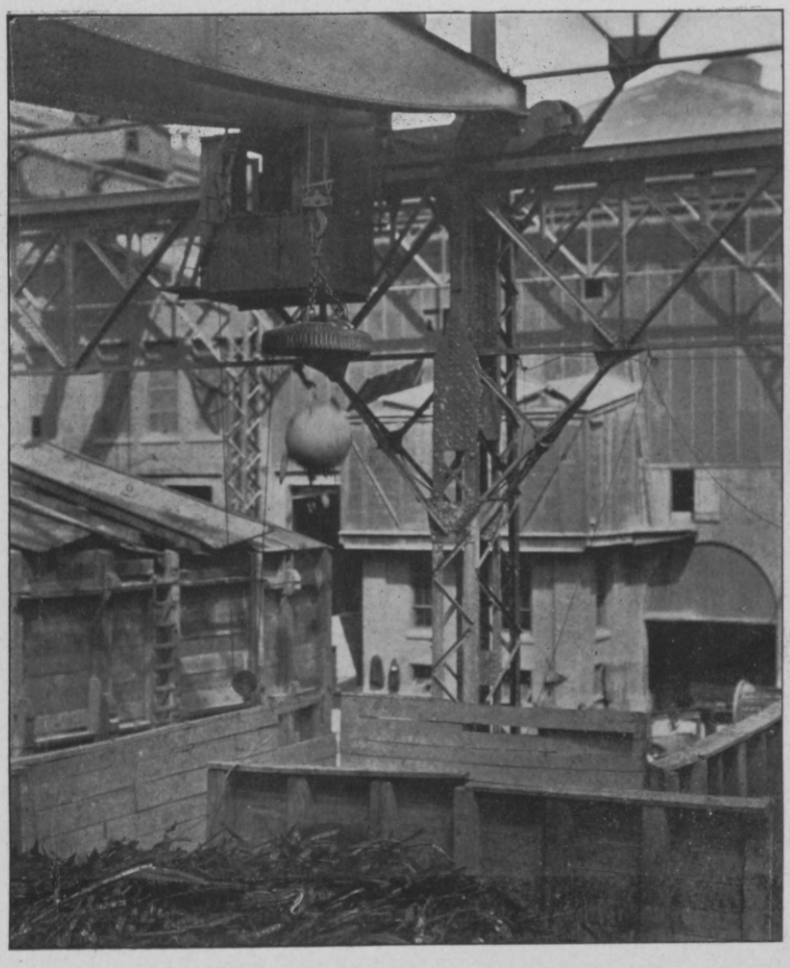


Fig. 15.—Magnet Dropping a Skull Cracker Ball.

opening of a circuit. If the magnet is fed from a separate circuit carried ahead of the circuit-breakers to the terminals of the generator, nothing short of the shutting down of the power plant or the breaking of the line supplying the magnet can deprive it of current,—contingencies which, in a well-organized plant, are more remote than the slipping of hooks and cranes.

In practice, the modern lifting magnet has proved a safe and dependable apparatus, with great labor-saving possibilities, and its more genaral use seems assured.

ALUMNI NOTES.

On New Year's evening in the rooms of the Engineer's and Architect's Club at Louisville, the Rose alumni of that place gathered to meet in a very informal way the Louisville undergraduates who were at home during the holidays and who had been invited to spend the evening with the ex-school boys.

Those of the alumni who were present entertained the undergraduates by telling how things were at Rose in their days and the latter responded by informing the very much interested Alumni as to how things are today. Socially all had a good time. Besides, there were refreshments and cigars for everybody. It is needless to say that the undergrads enjoyed themselves

Fig. 16.—Sheet Metal is most easily lifted off the pile when a Magnet is used. Afterwards the hooks are placed under the edges of the plate and the Magnet is released. Made by the Electric Controller and Supply Co., Cleveland, Ohio, U. S. A.

greatly and appreciated very much having the opportunity of meeting the men who claim Rose as their alma mater.

Those present were: Alumni, H. G. Brownell, '86, F. H. Miller, '95, O. G. Hess, '90, R. N. Miller, '01, A. C. Lyon, '01, A. G. Krieger, '03, H. W. Palmer, '03, A. W. Lee, '06, H. W. Wischmeyer, '06; undergraduates,—F. C. Dugan, '09, M. J. McWilliams, '07, B. O'Brien, '09, H. E. Schweers, '10, F. K. Wanner, '09, E. J. Miner, '07.

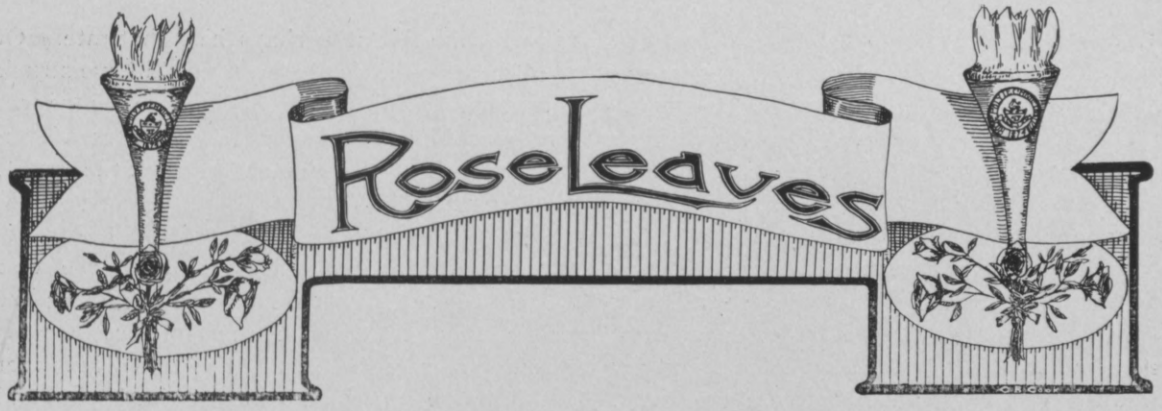
W. R. Heick, '05, stopped in Terre Haute just before the Christmas vacation for a couple of days while on his way to Louisville. Ky., where he is now connected with the Jos. McWilliams Co., Engineers and Contractors. Mr. Heick had been with the Westinghouse, Church, Kerr & Co. of New York where he resigned his position to go to Louisville.

W. H. Burr, '05, who is with the Westinghouse Electrical and Manufacturing Co. has been transferred from Pittsburg to the office at Philadelphia, Pa.

Leon Goodman, '05, has accepted a position in charge of the resurvey of a good many thousand acres in the Central States, including very extensive mine property. This resurvey promises to occupy a considerable length of time.

J. R. Curry, '06, has taken a position in the drafting department of the Murphy Iron Works at Detroit, Mich.

I. J. Cox, '03, was married to Miss Alice Lydia Chase at Kansas City, Mo. on January 1. Mr. and Mrs. Cox will be at home at Woodbury, N. J.



SAN FRANCISCO HARBOR AND ITS FORTIFICATIONS,

By NATHAN A. BOWERS, '10.

SINCE the days when the Spaniards first claimed all of the Pacific coast as far north as the forty-second parallel, San Francisco has been a military station. That it was early recognized as the strategic point on the coast was shown by the Spanish and later, Mexican fortifications that were established there. The importance of San Francisco is due to the fact that there is no other good harbor within five hundred miles either up or down the coast. San Francisco bay as a natural harbor is almost ideal; the surrounding hills afford lt shelter, the water is deep and the area large (the bay is sixty miles long and ranges up to four miles in width), thus affording ample safe anchorage for the largest vessels. But more than this, it is a natural stronghold because the only outlet to the bay is through the Golden Gate.

The "Golden Gate" is so often misunderstood by those who have never been privileged to see it, that an explanation may not be out of place here. Golden Gate proper is the narrowest part of the strait which connects San Francisco bay with the ocean. On the north side of the strait the waves wash against the base of a frowning cliff several hundred feet high ; on the south, the land slopes less abruptly to an elevation of four or five hundred feet, On the south side of the strait at its narrowest point and just at the outer edge stands a massive brick fort which was, in the days of muzzle loading cannon, considered all sufficient. This is Fort Winfield Scott and though the muzzles of ancient guns still threaten from its ports, it is now used only as a barrack. The distance from this fort to the opposite shore is a little more than a mile and through this channel must pass all incoming and outgoing shipping. As to why this should be called the Golden Gate : to one standing among the Berkeley hills some five miles to the east of the old fort about the hour of sunset, the sun appears to poise directly above the narrow break in the hills that marks the outlet of the bay. Through this opening one can look out over the broad Pacific as far as eye may reach. As the sun swings lower between the fort and the opposite bluff and seems to touch the horizon there appears a shining yellow pathway leading over the water toward the slowly sinking orb. The old fort is flushed with a ruddy glow and the opposite cliff, beside whose bulk the fort is so insignificant, seems fringed with a red-gold fire. The neighboring hills are already darkening; only through the narrow gateway comes the stream of light. The sun dips lower—is gone. For a moment a dull afterglow brightens the break on the hills and then it seems to the observer as if a charm had been suddenly broken. Again has Phœbus driven his glowing chariot through this golden portal into the dark waters of the Pacific.

Because San Francisco is the natural terminus

of trans-continental railroads and the gateway of a profitable trade with the Orient, the federal authorities have taken care to guard the important interests centered here. When the Maine was sunk at Havana there was a rush of heavy ordnance to San Francisco; a string of batteries was ranged along the bluff at the north of the Golden Gate; the famous thirteen-inch gun known as "Old Sally" was brought from Sandy Hook on two freight cars and planted where it could command the entrance to the bay, and far behind the hills fully two miles from the water, was placed a group of mortars for high angle fire. Since 1898 there has been a constant improvement of fortifications. Some distance up the hill from Fort Winfield Scott is a grove of tall trees which hide a strong line of twelve-inch rifles, perhaps the most important complement of the defense. Below these and protected by heavy concrete work lie nearly a score of the 10.3-inch rifles mounted on disappearing carriages. These guns are of the latest pattern and are regarded as the best grade of modern ordnance. The rifle proper, which is fixed to two movable arms, lies securely hidden during the operations of loading and training. When all is ready, the arms, operated by electric power, swing the gun upward and forward; as it reaches its highest position it is automatically braced so as to be perfectly rigid, belches forth its half-ton projectile and then sinks quietly back to cover as suddenly as it arose. Of course these guns use smokeless powder and as the outer side of their concrete protection is covered with sod, it would be well nigh impossible for the gunner of a hostile vessel to mark their location accurately, even though the guns rose to fire so frequently that a hail of shot descended about him. It was these disappearing rifles that made the phenomenal record at target practice three years ago. The target was a square based pyramid twelve feet in height which was towed across the channel some five miles from the batteries. When the guns opened fire the launch towing the target was making about five knots an hour across the channel and was drifting with the tide at perhaps half that rate. Of the thirteen shots fired eleven would have struck an ordinary sized war vessel whose centre was represented by the pyramid and of these eleven successful shots, three actually struck the target, smashing it to bits.

Almost the entire hill back of the old fort is government property and is used by the War Department. Guards are always on duty; the public may not inspect the fortifications too closely but from the broad drive that winds over the hill one will note concrete-lined pits and walls scattered over the slopes from the summit to the water's edge. Some extremely long guns with elaborate machinery attached to the carriages have recently been set at the upper edge of the grove. The authorities are very reticent about them and guards prevent anyone from getting more than a distant glimpse of them. The guns may embody some new feature that the government wishes to keep secret or perhaps it is feared that a possible enemy is keeping too close watch of the nature of guns installed. It is rumored that more of these mysterious guns are to be placed, and if this is true the public will probably be forbidden to visit the post altogether.

It was on these slopes back of the old fort that the block system of range finding was introduced. This system may or may not be the principle in use now. Only the gunners and heads of departments know. But as originally planned the system divided all of the water surface within range into imaginary squares. These squares were only a few hundred feet in width and the exact range of each was found, this data then being tabulated on a chart. Next a contrivance was arranged so that a pointer which connected with a small telescope placed on supports, would move over the chart following the movements of the telescope and indicating the distance of the point on which the 'scope was focussed. A similar telescope above the gun-pit and connected with the machinery of the gun carriage enabled the gunner to train his piece without raising same into view of the enemy.

Having the direction from his own observation and the range from an assistant the gunner could quickly set the indicators and instantly raise the gun to firing position. This plan has proved very satisfactory in New York harbor and is probably still in use there as well as at the Golden Gate if the authorities have not secretly adopted a better device.

These hidden batteries on the hill are by no means the extent of the fortifications. There are batteries of twelve and eight-inch guns both at Point Bonita and Fort Baker. The latter is a little way inside the bay on the north side and is the regular station of three companies of coast artillery. Opposite Fort Baker on the south side of the bay, is the historic Fort Mason. This post is the nearest to the centre of the city and from it came many of the men who did such efficient service during last April. Besides the infantry the garrison of this post consists of a company of the engineer corps and several companies of field artillery with full equipment of riot, siege and machine guns. There is no heavy artillery at Fort Baker owing to its exposed position, but between it and the Golden Gate is located the Presidio with its formidable fringe of twelve and eight-inch rifles supplemented with smaller calibre rapid fire guns. These command the harbor. The Presidio has always been military headquarters because of its ideal location and ample room for drill practice. The War Department has been constantly building and improving until now this is as complete and comfortable a post as has been been established west of the Mississippi. There are long rows of roomy brick bnildings for officers and men, well kept stables for innumerable horses—(shipments to and from the Philippines must pass through the Presidio as well as all cavalry in transit) and several square miles of carefully kept grounds which may be used for drilling and field maneuvers. The regular garrison of the Presidio is a complete regiment of infantry and other troops of cavalry. In addition to the land forces of San Francisco already named, there are complete plans for placing submarine mines in the harbor which could be discharged from shore. These mines are always on hand in the magazines and can be laid on short notice.

In regard to naval affairs, San Francisco is not so well equipped. At present the entire Pacific squadron consists of only the U. S. S. Charleston (flagship,) the protected cruisers Chicago and Boston, the gunboats Princeton and Yorktown and the destroyers Paul Jones and Preble. To be sure there is a reserve at Mare Island Navy Yard of two cruisers and four gunboats, but even so the condition is not entirely satisfactory and there has been considerable agitation of late about the matter. The report is now current that the navy department contemplates adding vessels to the Pacific Squadron and perhaps allotting a sufficient number to compose a fleet. At least there are certainly plans for more extensive naval operations with San Francisco as a base. Plans have been accepted for an immense army warehouse to be built at Fort Mason, and in connection with this considerable wharfage will be constructed for the transport service. The navy department is also establishing an extensive coaling station at California City on the north side of the bay. This station has been urgently needed for some time and its advent is of considerable importance and significance.

At Mare Island, situated in a branch of the bay well out of the way of a possible attack, there is a fully equipped naval station where ship supplies of all sorts are kept. This is the largest naval station on the coast and is supplied with every facility for the repair of vessels or engines.

Benecia lies some distance up the bay from Mare Island and is the site of the state arsenal. There is always a large supply of ammunition on hand here as well as small arms and army supplies. The magazines here are very carefully guarded and, if occasion demanded could be quickly replenished from the powder factories only a few miles to the southward.

There are three islands in San Francisco harbor proper and on each of these is a military or naval station. They are, to be sure, not strongly

fortified, but each has a small garrison and is connected by wire with the main points of vantage.

It has been proposed that a small station be established outside the Golden Gate, somewhere in the neighborhood of the Cliff House for the purpose of repelling landing parties. Within the last few months the government has accepted this suggestion and has purchased a suitable piece of land. This is an advisable move as vessels could now approach this point without exposing themselves to the fire of the heavy batteries, and while the vessel itself could not run in very close, it might land troops for a rear attack on the shore batteries or at least send spies to report the extent and location of land forces.

If one stand on top of Fort Winfield Scott on a clear day and scan the horizon to the westward carefully he will note there a shadowy outline almost beyond the range of vision. At first it is usually taken for a distant sail, but it is really the largest of an isolated group of small, barren rocks that rise abruptly from the depths of the Pacific. These rocks are known as the Farallones; their sides are precipitious, there is neither bay where a boat might land nor anything on the islands to make one wish to land, and until lately the navy department regarded them only as a menace to vessels. Now they play an important part in the system of coast defense. Long ago the Life-saving Service erected a light house on the largest island and now there stands beside it a modern wireless telegraph station. By means of this station, headquarters can be informed of the nature and location of incoming vessels long before they are in sight from the shore.

Another station of possible advantage to the war department is that which has been installed on Tamalpais. This peak has an elevation of twenty-two hundred feet and is eight or ten miles north of the Golden Gate. Side by side on its summit stand two slender towers,* each three hundred feet high and between them are stretched the antennae of a wireless station of unusual power. The erection of these towers was a difficult engineering feat and owing to their great height and the peculiar disadvantage of working on the narrow top of a steeply sloping ridge, it seemed for a time as if the project would fail. But the towers were finally anchored securely in an upright position and the remainder of the plant installed. The apparatus, which is very elaborate, is the best obtainable. With this extensive equipment on a high peak facing the ocean it is expected that much will be accomplished. Already some encouraging results have been obtained and it is hoped that before long this station will be able to hold communication with the Philippines.

*These wooden towers were blown down in a gale early in December and are to be replaced by steel structures.

THE MANUFACTURE OF COMMERCIAL FERTILIZERS.

By A. B. PURDOM, '08.

PLANT life demands and must have certain elements supplied to it for its growth and development, and where the soil is lacking or deficient in these elements, as nearly all cultivated soils are, it is the mission of the commercial fertilizer to supply them. The mere statement that by the judicious use of these artificial plant foods "the most fruitful fields may be made to yield larger crops, and that any field fallen behind in fertility may be brought up to its normal condition again," would alone suffice to place these products of modern chemical research among the great benefits conferred by science upon mankind.

While there are many compounds capable of supplying plant food in one form or another, the complete fertilizer contains a certain percentage of what is termed "available" phosphoric acid, nitrogen and potash, all of which must be in a form readily assimilated by plant life.

Gypsum was formerly the principal source of

the phosphoric acid, but now the normal phosphate rock is used almost exclusively. It is ground to a powder and then treated with sulphuric acid.

Either nitrates or ammoniates may be used to supply the nitrogen, and the varied sources from which they may be obtained make them comparatively easy to secure. Besides deposits of them in different parts of the world, cottonseed meal, fish scrap, and packing house products such as tankage, dried blood, etc. are all used as ammoniates.

The potash is obtained from the world-famed potash salt mines of Germany which are owned by the German Government. The American broker or manufacturer not only has to pay Government prices for this costly and highly necessary ingredient, but he has to accept the Government weights also.

Before the mixture of the soluble phosphate, the nitrate or ammoniate, and the potash salt can be termed a complete and balanced fertilizer, a filler, consisting of finely ground slag, shells, or even finely pulverized dirt, must be added. Although worthless as a plant food, it is of service to the manufacturer, for it reduces the amount of expensive nitrates and potash salts used, thus enabling him to put the product upon the market at a reasonable price, and it is of value to the farmer for it counterbalances the effect of those highly concentrated as well as expensive ingredients and gives "body" to the product, which makes it easier to apply.

An analysis is absolutely essential to determine the value of a fertilizer. Though it tells the story much better than the catchy names which so often adorn the sack and which sound so pretty to the rural ear, the latter not infrequently determines the buyer's choice.

In most factories wheelbarrows and trucks are used to convey the different materials from the warehouse to the scales and mixing machines, and for loading and unloading cars. But despite these apparently crude and expensive operations, the farmer may buy the product at a reasonable price and be assured that he is getting a fertilizer fully sixty-five (65) per cent. more efficient in supplying plant food than the best home compost.

Modern fertilizer manufactories have their own sulphuric acid plants to make the acid used in converting the insoluble phosphate into the soluble form. The fact that these plants approximate nearly half the total cost of the enterprise is sufficient proof that a cheaper method of inducing sulphur to combine with hydrogen than the present day leaden-chamber process, would indeed be a boon to the manufacturer.

Experiments have shown that most plants prefer nitrates to ammoniates as a source of ammonia. With the vast supply of nitrogen in the air, and a cheap method of making use of it in the form of nitrates, scientists claim that the present food producing capacity of the earth would almost be trebled.

When it is recalled that in the best commercial fertilizer the real plant food is only a scant twenty-five (25) per cent. of the total weight, the other seventy-five (75) per cent. giving it body, but being of practically no value as available plant food, the inefficiency of the product becomes apparent. This fact together with the possibility of cheapening the handling methods now used, and of securing an inexhaustible supply of nitrates from the air makes the manufacture of commercial fertilizer an industry of great promise.

SONGS.

THE TECHNIC is in receipt of a copy of "The Most Popular College Songs," published by Hinds, Noble & Eldridge. It contains many of the old timers such as "Forty-nine Bottles" and others of that sort. There are also songs of many of the large colleges and while "Here's to Good Old Rose" is missing, maybe we all know that anyway.

THE TECHNIC will be glad to give the address to anyone wishing to get one of these books.

An announcement has been received of the proposed publication of a new technical journal, "Technical Literature." It is to be devoted to the reviewing and indexing of the more important articles in the technical publications, and the review of new technical books, both American and foreign. The editor and publisher, Mr. Frost, has been with the Engineering News for some years, and the reviews will follow the standard set by that journal in its engineering literature supplements.

The Orchestra, Mandolin Club and Glee Club are holding regular rehearsals preparatory to a Symphony Club concert, which it is proposed shall be given in the latter part of Feburary.

The Glee Club is preparing a progam for a concert to be given at Maple Avenue Church on February 15th with prospects of another one at Clinton later in the month.

Why not revive the Rooter's Club?

The last month has been a quiet one for athletics at Rose and the interim between the football and basketball season has been filled in with only the regular basketball practice.

About fifteen candidates have been out regularly and from these Captain Trueblood thinks he sees the possibility of a team which can make a creditable showing.

The opening game, as per schedule—the Wabash game at Crawfordsville, Jan. 11, was cancelled by Wabash and a game was arranged for with I. S. N.

Rose will meet some unknown quantities when the games under the Conference rules are played and just what the outcome will be, will be found out later. Last year, Purdue refused games with us and this year there has been guessing as to what the outcome will be; anyway, it is to be hoped that the score will be a little better balanced than 53–10.

The following notes are given by the Purdue Exponent as interpretation of the new Collegiate rules which differ from what have been played by in former games at Rose. Of the games scheduled by Manager Miner, the games with Purdue, Wabash and Indiana will be played under the following changes:

Rule 6, Sec. 3. Amended: When a player intentionally passes the ball to out of bounds, it shall go to the other side. Note: To intentionally pass the ball out of bounds, it should be clear to the official that the player so intentionally passes, that he or one of his own side may regain the ball. This does not prevent a player who accidentally causes the ball to go out of bounds by missing a difficult pass (the ball carroming from his hands or body) or when in a scrimmage or double the ball is unintentionally forced out of bounds to regain it.

The official should be prompt in rendering a decision in all out of bound plays. Note: When the ball goes to the other side he should blow his whistle and call the name of the team entitled to the ball.

Rule 10, Sec. 1. Amended: Any actual holding of an opponent with the hand or arm or impeding his progress more than momentarily, shall be considered holding. Note: The player must clearly be playing for the ball and not for the man.

Rule 8. Note: —It is understood that one step in any direction is permitted, except to out of bounds. Note:—Lifting the rear foot from the floor after the step, is permitted.

Rule 22, Sec. 8. Amended: Note:—Two men having hold of the ball constitutes a scrimmage.

Rule 21, Sec. 3. Players shall stand as they would in center circle as to distance apart and position. Note:—A center should stand in his own half of the center circle.

Rule 18. Corrected to read: The official shall toss a coin and one of the captains shall call.

Rule 15. Corrected to read: A foul is a violation of a rule, the penalty for which is a free throw for goal.

At this time it will be well for students who wish to be eligible for positions on athletic teams,

to remember Rule 6 of the rules governing athletics as published in THE TECHNIC of last November, which reads,

"No student shall be permitted to take part in any inter-collegiate contest who is found at the time of the contest to be delinquent in any study for which he is registered, nor who has unremoved conditions amounting to more than four hours per week in the aggregate in the work of previous terms."

This rule is now in force and applies to the basket-ball, base-ball and track teams of this year. When the comparatively small number of our students who find time and inclination for activity in athletic sports is considered, the loss of one or two men from a team may greatly reduce its efficiency, and it is unfortunately true that sometimes the men best in athletics have reached that position at the expense of their scholastic standing. In order to keep our athletic reputation anywhere near what it has been in the past, the men who find their cases covered by the rule above quoted, must do some hard work at their studies, and do it now. The maximum result for the minimum effort under these circumstances is to be had by studying hard enough to retain a place or a chance for a place on the team.

This is not a false alarm or a bugaboo to scare delinquents. Dr. White has already notified several baseball players that their class standing must be improved or they will not be permitted to play on the team. The rule will be rigidly enforced and the man who is not ready for it will have no ground for a protest.

It is to be hoped that the question vital to every team, viz: the choosing of competent officials, will not trouble the basket-ball team as it did the 1906 football team. Heretofore we have fared fairly well, but the football schedule just closed furnishes an example of what might happen when men officiate who apparently know little and care less, about the rules.

True enough, this didn't occur at every game but this is one time when more defeats may be attributed to inexperienced officials than to the so-called Poly luck.

The basket-ball schedule as arranged by Manager Miner is as follows:

January 12—I. S. N. at Terre Haute.
" 14—DePauw at Greencastle.
" 15—Purdue at Lafayette.
" 18—Earlham at Richmond.
" 19—Miami at Oxford.
" 26—Wabash at Crawfordsville.
February 2—Open.
" 4—University school at Louisville.
" 5—New Albany Y. M. C. A. at New Albany.
" 6—Indiana at Bloomington.
" 9—DePauw at Terre Haute.
" 16—Wabash at " "
" 23—Purdue at " "
March 2—Indiana " "

Two games have been promised with I. S. N. but the second date has not been fixed.

ROSE, 41; I. S. N., 16.

The basket ball season is on and was started with a victory over I. S. N. When a practice game was played before the holidays between Normal and Rose and after several minutes spent in chasing each other, and changing men—to say nothing of delaying the game to coach the players—the score was ours by a narrow margin, it was settled then and there that we were easy.

The game Saturday night, January 12, was the first of Miner's scheduled games and the second of Normal's, they having played Purdue. The crowd was one of the largest that ever witnessed a basket ball game in Terre Haute and the balcony was full to overflowing—the overflow finding room at the ends of the gym floor.

The game was called by Referee McCormick at 9:20. From the first the pace was fairly fast but it was almost five minutes before the goal-throwing started. Normal made the first field goal. After a double foul, Webster started the field work for Rose. Normal fouled twice and both were turned into goals. Webster fouled but made up by making a field goal. Fouls were frequent in this half and proved costly to the Normals. Smith and Trueblood were given

Class B. fouls with a don't-do-it-again from Referee McCormick. The half ended faster than it began and the score stood 23—8 at the end of the twenty minutes, with the 23 for us.

The second half started off fast, the Normals trying to even up the score and Poly to see how big they could make it. Normal attempted some dribbling but not being successful returned to the old style of play. Everybody had become interested in the game when an I. S. N. pennant in the balcony caused a little delay of the game. The pennant question settled, the play was again started. The score then began to go up when Webster and Lindeman got their eyes fixed goal-ward. McCormick about this time thought he saw Smith and Trueblood making eyes at each other and immediately sent them to the sidelines. Hadley replaced Cece while Schockel went in in place of Smith. With only a few minutes to play Rose started again and though their team work was slightly disturbed, no bad results were forthcoming and the final score was 41—16.

For Rose, everybody seemed to get in the game, the team work being a feature of the game. In team work, Trueblood seemed to set the pace, running every place at once despite the fact that he was carrying the Normal center most of the time. For goals, Lindeman had six to his credit, with Webster four, Shickel four and Schmidt two.

Normal made thirteen fouls to Poly's five.

LINEUP.

I. S. N.		ROSE.
Lovelace	Forward	Webster
Tribble	Forward	J. B. Shickel
Smith / Schockel	Center	Trueblood / Hadley
Worthman	Guard	Lindeman
Harbaugh	Guard	Schmidt

Field goals—Smith, 2; Tribble, 2; Harbaugh, 1; Worthman, 1.

Webster, 4; Lindeman, 6; Schmidt, 2; Shickel, 4,
Foul goals—Worthman, 4; Shickel, 9.
Final score: Rose 41; I. S. N., 16.
Referee: McCormick.

ROSE; 2nd., 21; I. S. N., 2nd, 17.

The varsity game was preceded by a game between the second teams of Rose and Normal. The game was closer than the second and at the end of the first half, the score was 5 to 2 in favor of I. S. N. The second half, however, was sufficient time for us to get the lead.

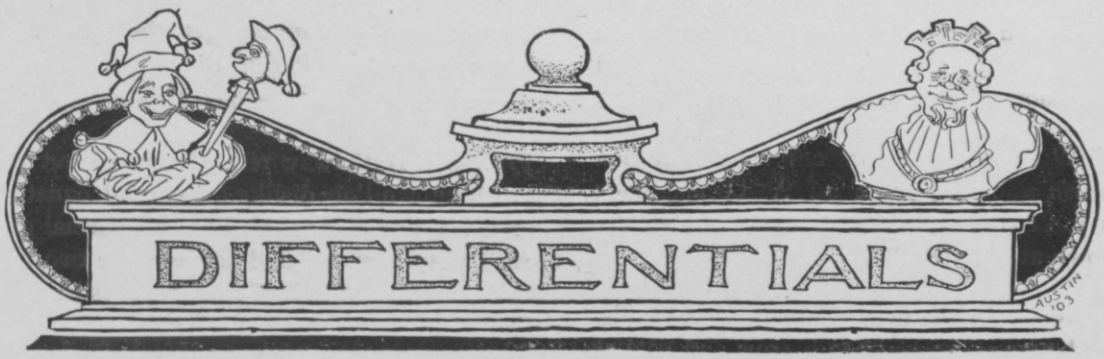
Fouls were plentiful, there being 17 called on each side.

Nobody seemed anxious to take all the glory but Hadley and Nicholson lead in the number of field goals.

LINEUP.

I. S. N.		ROSE.
Schockel	Forward	Nichols
Phillips	Forward	Nicholson
Sanders	Centre	Hadley
Wood	Guard	H. M. Shickel
McReynolds	Guard	Curry / Post

Summary—Score: 21—17; Rose.
Field goals: Nicholson, 3; Hadley, 5; Nichols, Shickel, Schockel, McReynolds, Sanders, 2.
Foul goals: Hadley, 3; Sanders, 6. Points awarded I. S. N., 2; Rose, 2. Halves, 15 mins.
Referee: Markle. Umpire: Kisner.



Sage :—"We have here a second room story."

Bennett (translating Mondregenbogen) "The rainmoonbow."

Johnson, '09 :—"Six hundred divided by seventy-five is four."

The November *Wabash* contains some good football pictures and writeups.

A crowd of Normalites attended the Grand on December 7th to see a Dark House.

Stephens (translating German):—"She laughs so sweetly that he thinks that he must bite her."

Bennett (as Grammar finishes translating): "That will do Mr. Grammar, or rather it won't do."

Prof. —— says that the principal use of the block and tackle is to raise the sails on steamboats.—*The Crimson.*

Trueblood :—"In a two-pipe system, one pipe carries hot steam and the other cold steam."

Nantz (explaining problem in Heat and Ventilation):—"I have a school room and thirty-five children."

Leeds :—"Will our sight translation be on that part of the book that we have been over?"

"Is your wife entertaining this winter?"

"No, not very."—*Purdue Exponent.*

Leeds :—"Well, isn't the sexton religious?"

Bennett :—"Well yes, he rings the church bell."

Prof :—"I'll give you a zero for that last cut."

Student :—"Fahrenheit, centigrade or absolute?"—*The Crimson.*

Doc White :—"I hope that you have all had a pleasant Christmas and come back full of good resolutions."

Mosby :—"We got back full all right."

Hath :—"Yes, there have been many students here who were known as Hath sub one."

'08 from rear :—"But we have the real thing now."

Doc White :—"I want you to take a dime and dissolve it to make a quantitative determination of it."

Dutch McCormick :—"Won't two nickels do just as well?"

Bennett :—"When I was young we called it mode, but as I have grown older it has become mood."

Mosby :—"And pretty soon it will be mud."

She : —"Are you dining anywhere next Sunday?"

He (expectantly):—"No, I don't think so.'

She :—"How hungry you will be on Monday."

Williams (in electricity):—"If some night you look at an arc light and your head shakes you may see a dozen lights at the same time."

Prof. Williams:—"Before our next recitation I wish you would examine an A. C. machine; if you can't find anything better, look at the ones down at the shop."

Bennett:—"In German there is no such distinction between the verbs to borrow and lend as there is in English."

Wick:—"Well maybe they don't need the money as bad as we do."

Fair Normalite (at boarding house):—"My, but these apples taste flat."

Purdom:—"Maybe they fell from a high tree."

What you say goes," he sadly said,
With eyes and and heart aflame,
She glanced at the clock, and turned her head
And softly murmured his name.

—*Exchange*

Leeds:—"Do they really have thirty-three men on the stage at once."

Bennett:—"Sure, you wouldn't think anything at all of that if there were that many girls on at one time."

The following new exchanges have been received since the last issue of THE TECHNIC:

The Northwestern—Northwestern University.
The Monmal—Montana State Normal College.

Bennett (when class kicks on the length of the exam.):—"Why that's nothing, it took me an hour and a half to prepare them and six hours to mark them and I had to get up five minutes earlier to copy the marks."

"He mixed some nitro-glycerine—
They say his name was Bob—
Obgleich man suchte überall,
Sie fanden nie den Knab'."

—*The Wabash.*

Homberger:—"You can get the scheme for the iron group from Perkins."

Treeman:—"I don't believe I know him."

Professor Hathaway recently found out that the well known Poly dislike for normal equations is matched by the unfriendliness of Normal girls toward poly-nomials, and between the two antipathies, mathematics in Terre Haute is likely to suffer.

Bennett (as White translates Rösselmann):—"You have to wrestle with that name every time you translate it. (Deep silence on the part of the class). Well you don't have to laugh at my jokes if you don't want to."

"Now I lay me down to sleep
In my little bed,
Exams begin tomorrow morn,"
The sleepy crammer said.

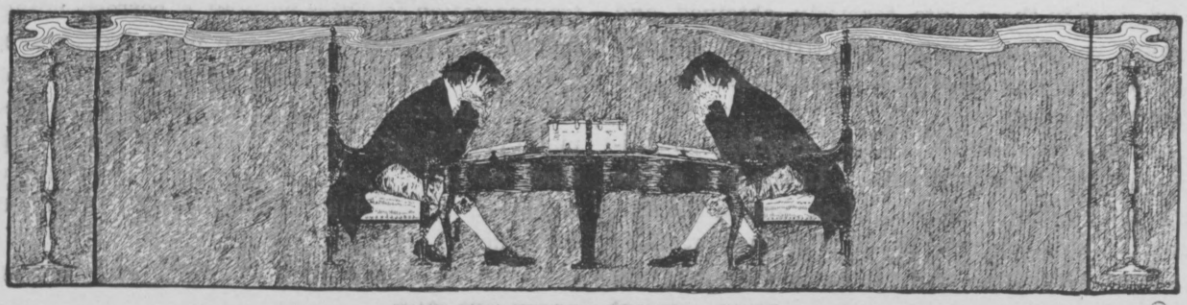
"Now I lay me down to sleep
In my little bunk;
Hope I die before I wake
And thus escape a flunk."

FRENZIED FINANCE.

What is the cost of a year at Poly? The father of a promising candidate for admission to the Freshman class takes down the catalogue of the Institute and reads on page 37: "The entire expenditures for tuition, board and materials may, by the exercise of very rigid economy, be brought within $300.00. He then proceeds to make an estimate in the following manner, based on information given on the same page:—

Tuition, Students' Council, and Incidentals	$110.00
Board—29 weeks—at $3 00	117.00
Text-books; Instruments and Materials	25.00
Room-rent—9 months at $5.00	45.00
Laundry—39 weeks at $ .02	0.78
Christmas vacation	0.23
One hair cut	0.15
Two shaves	0.20
Clothes	0.98
Railroad fare	0.66
	$300.00

—With apologies to *Purdue Exponent.*



REVIEWS

RECORDING PYROMETERS.

While the Le Chatelier indicating pyrometer is an admirable instrument as far as it goes it is inadequate for the needs of a manager who wishes to study the conditions which have been prevalent during the working period. In order that the failures may be eliminated and the successes repeated it is necessary that a record of the working of the pyrometer be made and kept. One of the best of the recording pyrometers is also of the Le Chatelier type.

"One type has its record sheet mounted upon a drum, and each sheet accommodates a record of twenty-six hours' run. The instrument is in a solid milled aluminum case, which, of course, cannot warp. The needle carries a reservoir pen, and the drum, counterbalanced and controlled by clockwork, comes to meet the pen at short intervals. The record is very distinct, and its variations from a straight line show the changes in temperature. An excellent feature is the very open scale secured by having a width of 4½ inches for the record.

In the second type a stylus projects down from the galvanometer needle. Under the stylus travels a carbon belt, and under that is the record paper. Over the needle there is a beam, which is one piece, with two arms supporting it. This beam is raised by clockwork, and is allowed to fall of its own weight once a minute. The needle, which has been free to swing to its proper position, is depressed by the beam, and the stylus causes the carbon belt to make a dot on the record paper.

The record paper is thin, but opaque, and is in the form of a very long ribbon wound upon an aluminum spool. A single spool carries enough of the paper to last a whole year of continuous running.

The current generated in the thermo couple, and which it is the duty of the recorder to measure, is the only electric current that has any function in the instrument, as the whole recording operation is controlled by an eight-day clock. By not employing any relay currents all danger of direct or induced changes in the light current to be measured is avoided. Each instrument has two different internal resistance valves, either of which may be employed by using the proper binding posts, of which there are three."
—*Electrochemical and Metallurgical Industry.*

SHEAR TESTS IN CONCRETE.

The difficulty of obtaining accurate results from experiments to determine the shearing strength of concrete lies to a great extent in the design of the apparatus used. Results obtained by using apparatus similar to a steel shear, or by punching are shown to be only approximations.

The *Engineering Record* describes some experiments made at the University of Illinois from which some very important results were obtained.

Heretofore assumptions have been made concerning the bearing, pressure and beam action accompanying shearing tests which, as the *Record* points out, are hardly correct. This may account, to some extent at least, for the wide

variations in the results formerly obtained, and which variations cannot be attributed entirely to the different qualities of the concrete test pieces employed.

In the experiments at the University of Illinois two methods were used. In the first a hole was punched in a concrete block and in the second, a short concrete beam restrained at both ends was broken. Prof. Talbot suggests testing a beam loaded evenly over its depth instead of its top.

"The experiments indicate that the shearing resistance of concrete depends on the strength of the stone as well as on that of the mortar, and in rich mixtures the stone seems to exercise a greater influence than the mortar. Concrete 60 days old, made of hard limestone and mixed 1:3:6 will have a shearing resistance of about 1100 pounds, and a 1:2:4 mixture of a resistance of about 1300 pounds.

Prof. Talbot is of the opinion that when some accurate method of measuring simple shear is invented the results will be above rather than below the figures given. One interesting point brought out by the tests is that the practice of expressing the shearing strength of concrete as a percentage of the compressive strength is hardly justifiable, for the former is influenced larger by the strength of the aggregate and the latter by the strength of the mortar. It is frequently done, however, and the results of the University of Illinois tests show that the shearing strength is generally at least 50 per cent. of the compressive strength and may exceed 75 per cent. This is an important fact, as it is often asserted on the strength of tests by Bauschinger, Mesnager and others that the shearing resistance is much less.

EFFECT OF HEAVY ROLLING EQUIPMENT.

The problem of providing for the great increase of heavy rolling equipment is discussed in a recent number of the *Railway Engineering and Maintenance of Way*.

"The present tendency to furnish greater transportation facilities without a corresponding increase in transportation expenses, provides an exigency which must be met by the mechanical and engineering departments alike. The demand is for heavier motive power and for rolling stock of greater capacity as well as for more commodious terminal facilities and additional side tracks

Reflection upon the recent orders of two prominent railroad companies for heavy locomotives of the Mallet articulated type for road service, as well as upon the work of a similar type of engine which has been in pushing service for some time, leads to the conclusion that the use of this class of power is beyond the experimental stage and that further development may be expected along this line.

There is a case on record of a railroad company disposing of a locomotive which it had ordered, because the engine, as built, was too heavy for the roadway and bridges. The continually increasing size and weight of locomotives would indicate that further developments may be looked for. This factor must necessarily be reckoned with by providing tracks and bridges capable of carrying not only the class of power now in service but also that which it is natural to anticipate during the next ten or fifteen years.

The fact that some companies are still furnishing locomotives of increasing weight, must influence other lines to prepare for the transportation of such power in transit, even though they do not contemplate the installation of such power on their own roads.

The effect of this constantly increasing weight and size of locomotives will soon be, if it is not already, felt, on account of inadequate facilities for handling the larger parts during repair work. Longer turn-tables of greater capacity will be required ; larger roundhouse and repair shop pits will be needed, as well as cranes of greater capacity, and this necessarily directs attention to the columns and girders to support the greater weights carried by the cranes.

These and many other features incident to provisions for increasing transportation facilities, tend to show that enlarging the capacity of one department must be accompanied by corresponding preparations in the other departments."